SPORTSHIELD PROJECT
ANTI-THEFT CONNECTED DEVICE

ALGOSUP project kick-off
11.03.2024

CORIS INNOVATION

PRESENTATION HIGHLIGHTS

01. Coris Innovation

02. Projet brief & background information

03. Electronics

04. Embedded software

05. Key performance & reliability indicators

CORIS INNOVATION

CORIS INNOVATION

Founded in 2015

90 employees, 1 team

5 locations : France (Annecy, Grenoble, Lyon, Bourges) & Switzerland (Gland)

1 in-house Innovation Lab

Our jobs : Systems Engineering and Process Engineering

Our key business sectors : Aerospace, automotive, energy, railway, pharmaceuticals, watchmaking

Our **ambition** is to **support** European **industrial players** in their innovation, R&D, digitalization and production **challenges**. The development of our **team** is key to the projects **success**.

www.corisinnovation.com

PROJECT BRIEF / BACKGROUND INFO

"SportShield is an innovative anti-theft device designed for sports equipment, equipped with sensors and actuators to detect movement, activate an alarm, and notify the owner"

PROJECT BRIEF / BACKGROUND INFO

Target Audience:
- Individual users of medium to high-end skis and snowboards
- Plans to expand to other sports equipment, camping gear, musical instruments, locker rooms, etc.

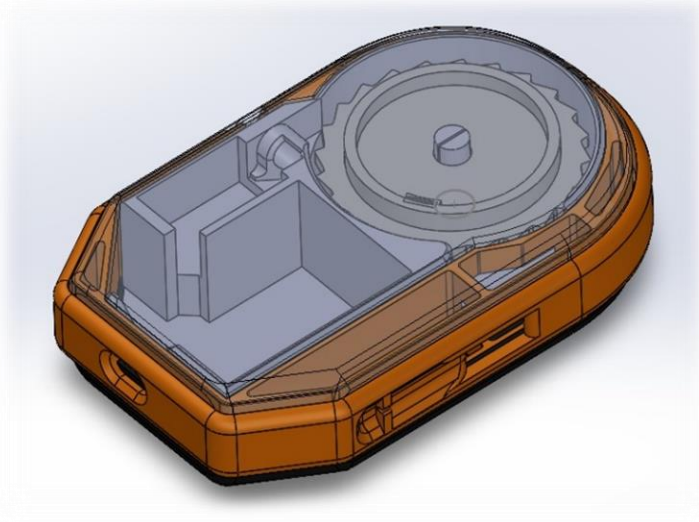
Product:
- Currently in development phase

Alarm System:
- Emitting audible signals upon detecting movement with the 6-DoF IMU
- Moderate-level beeps for slight movements, loud alarm for significant ones
- Notifications sent to owners via GPRS connectivity.

Physical security Features:
- Multi-layered cable and electromagnetic lock for physical security.
- Cable automatically retracts into the housing and prevents unwinding when locked.

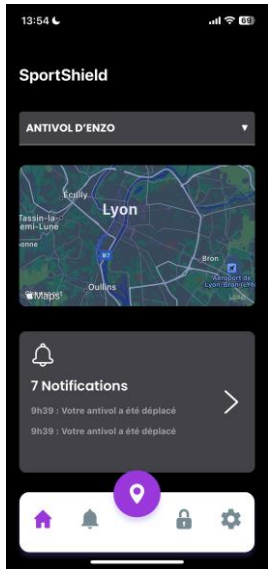
Mobile App :
- Main functions : Activate/deactivate the anti-theft alarm
- Unlock the device via Bluetooth connectivity.
- Check device localization on a map

Robustness:
- Waterproof, cold-resistant, and robust against break-in attempts.



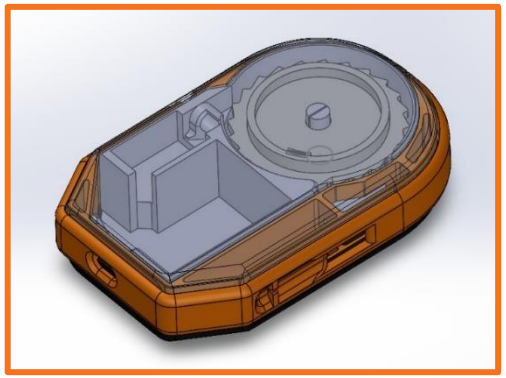
PROJECT BRIEF / BACKGROUND INFO

Mobile app



Communicates with Bluetooth
Unlock function + Activation function + First pairing

SportShield device



- User info (ID and password)
- Device info:
  device name and ID
  GPS coordinates
  battery level)
- Shock notifications

Firebase

Database
User accounts management
Notification management

API
installed on VPS

HTTP Post
protocol

Send GPS
coordinates &
battery level

ELECTRONICS

ELECTRONICS

- Xiao BLE Sense nrf52840
- 2 x 2 x 0,5 cm
- BLE 5.0 & 6 DoF IMU
- 11 GPIO (UART, SPI, I2C)

- GNSS PA1010D
- 2,5 x 2,5 x 1 cm
- Integrated antenna
- UART & I2C

- GSM/2G SIM800L Module
- 2,2 x 1,8 x 0,5 cm
- GPRS & HTTP, UART
- SIM Card holder
  → *With 1NCE SIM card*

ELECTRONICS

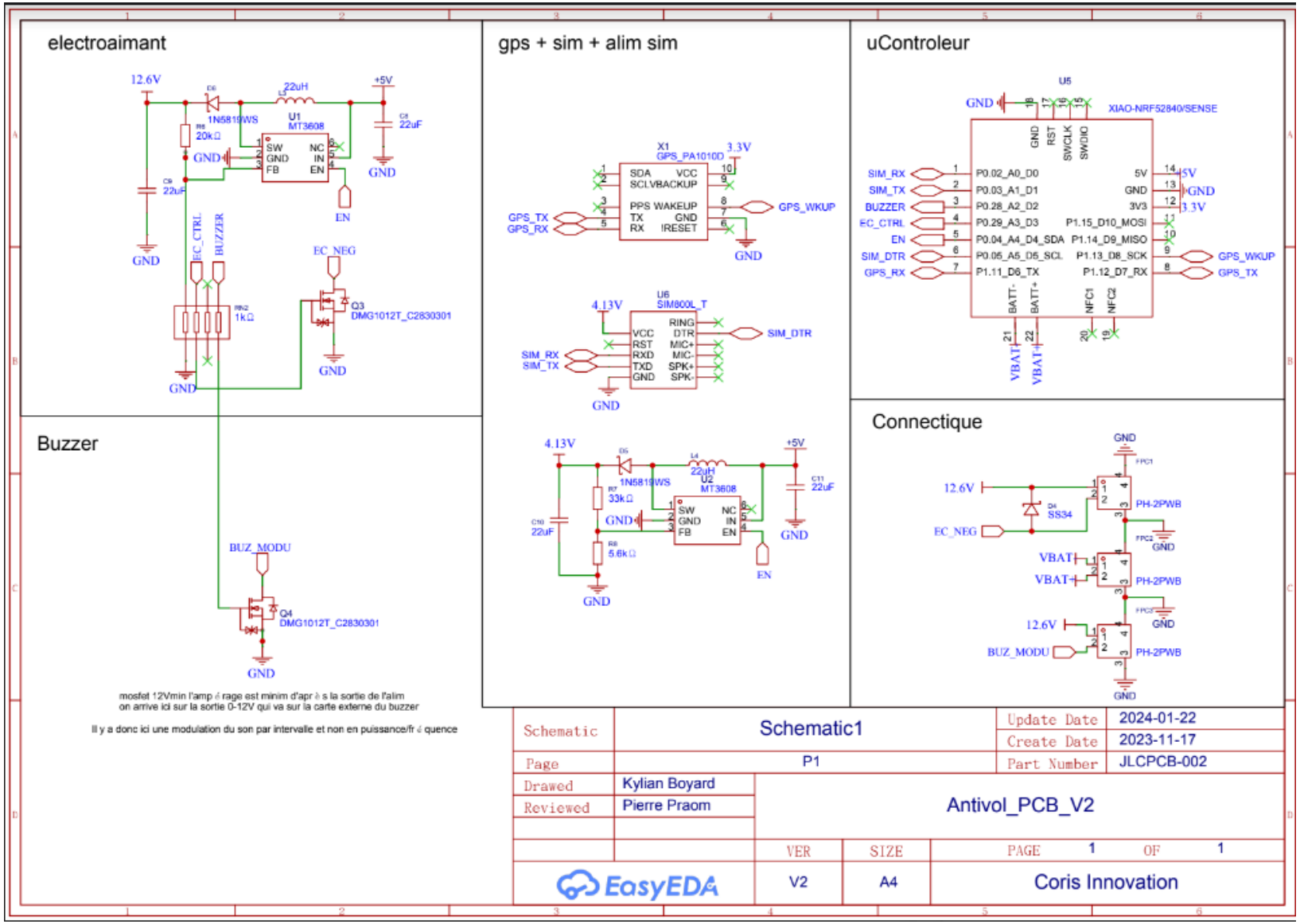
- Electromagnet
- 12V, 500mA
- 2,7 x 1,6 x 1,3 cm

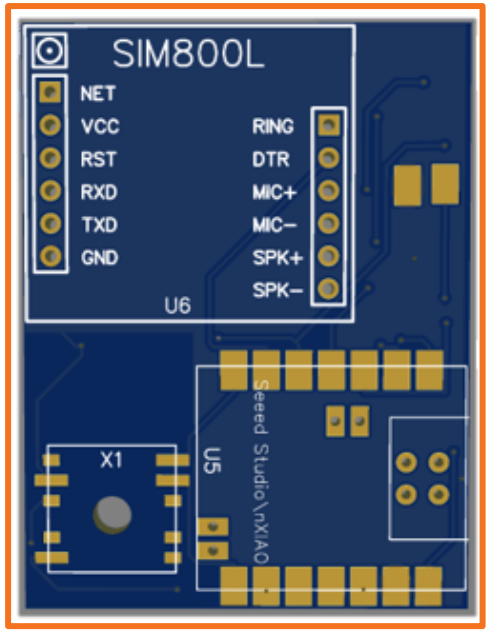
- Piezoelectric buzzer
- 12V, avec oscillator control circuit
- ~ 90-100 dB

- Lithium-Polymer battery
- 5,1 x 3,5 x 0,6 cm
- 3.7V, 1100mAh, 4.1Wh

- NFC antenna
- 5,5 x 4,5 x 0,017 cm
- 13,56MHz frequency

ELECTRONICS





EMBEDDED SOFTWARE

EMBEDED SOFTWARE

Work environment

- Language : C / C++
- IDE for compilation & upload on the board

Main libraries

- NRF52_MBED_TimerInterrupt V1.4.1
- ArduinoBLE V1.3.6
- Adafruit GPS Library V1.7.4 (instal all)
- Sim800L http connector V1.14.0
- Seeed Arduino LSM6DS3 V2.0.3
- OneWire V2.3.7

EMBEDED SOFTWARE

ALREADY IMPLEMENTED FEATURES

Connexion to the device

- Allowed to all users by default
- ‘MAC Address’ characteristic is read only, useful for the device pairing with the user account on the mobile app.

Activate / turn off the anti-theft function via Bluetooth

- ‘Activation’ and ‘Unlock’ characteristics are accessible only after the user has sent the right password (written in ‘Password’ BLE characteristic)
- 0 (turn off) or 1 (activate) is sent to the mobile app via BLE characteristic

Unlock the security cable via Bluetooth

- ‘Activation’ and ‘Unlock’ characteristics are accessible only after the user has sent the right password (written in ‘Password’ BLE characteristic)
- 1 (unlock) is sent to the mobile app via BLE characteristic

EMBEDED SOFTWARE

ALREADY IMPLEMENTED FEATURES

Alarm

- 3 light sounds when a light shock is detected
- 5 long high sounds when a strong shock is detected

Send movement notification via GPRS (when a strong shock is detected)

- Route : http://141.94.244.11:2000/sendNotfication
- Message in JSON format as follow (example): {"latitude":"2.894587573","longitude":"6.5467554"}

Send GPS position and battery level every 15 minutes

- Route : http://141.94.244.11:2000/updateCoordinate
- Message in JSON format as follow (example): {"latitude":"2.894587573","longitude":"6.5467554","batterie":"3.68"}

Sleep mode

- GPRS and GPS functionalities are powered only when an information should be sent.
- When the antitheft system is deactivated, and no movements are detected for 5 minutes, then the BLE function is disabled. As soon as a movement is detected, the BLE turns on again.

EMBEDED SOFTWARE

EXPECTED IMPROVMENTS

Battery consumption management

- Improve energy efficiency of the system (e.g. turn on components only when needed, sleep modes management)
- Management of a low battery situation (e.g. skis are secured and electromagnet cannot be powered to release the cable)
- Increase the battery lifespan (e.g. no charge above 80% of Vmax, no discharge under 20%)

Device management with NFC

-NFC is an expected feature for the users, in order to activate/deactivate the anti-theft system & unlock the cable
- Via their smartphone and SportShield app (redundant with Bluetooth function, to increase control options for users)

Alarm management and simultaneous actions

- Add the possibility to stop the alarm when it rings, even if the ringing cycle is not finished.
- Permit the alarm to ring while sending http notification to the server.
- Better management of interruptions

Security issues

- Increase the security level to connect to the key features of the system

→ access to activation/deactivation of the alarm and unlocking of the cable

KEY PERFORMANCE & RELIABILITY INDICATORS

KPIs & RELIABILITY INDICATORS

Minimal functioning rates

- Shock detection: 99% (1st most critical function)
    - o Accuracy of the detection itself, and accuracy of the detection level (small or major movement)
- Unlock: 99% (2nd most critical function)
- Alarm: 98% (perceived quality of the system)
- Shock notification: 95%
- GNSS position acquisition and transmission: 80%

Battery operating time between two charges

- 7 days operating duration (minimal requirement)
- Considering 6 hours activation mode + 18 hours in stand-by (not activated) mode per day

QUESTIONS ?

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