

Final project - Demo

BIKELOCKER

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- BikeLocker that keeps your bike safe
- BikeLocker that helps you monitor your ride
- BikeLocker that reminds you of your bike
- BikeLocker that does not lock yourself

Overview

- Bike is important for NTU students
- Bike is easy to stole
- Naming: Bitlocker is self-locking

Motivation

Approach

MOTIVATION

APPROACH

RESULT

REFERENCE

測試 BLE 在 App 端的可行性
(開發平台 / Package)

協調 BLE 等共同部分
(UUID / 資料格式)

完成 App 端共同部分
(基礎UI / BLE資料收發)

STM與App整合測試
(Debug)

實現其他 App 端功能
(優化UI)

實現其他 STM 端功能
(蜂鳴器 / 資料應用)

額外功能實現
(有空再說)

實現基礎 STM 端功能
(LED / 按鈕解鎖 / 加速度)

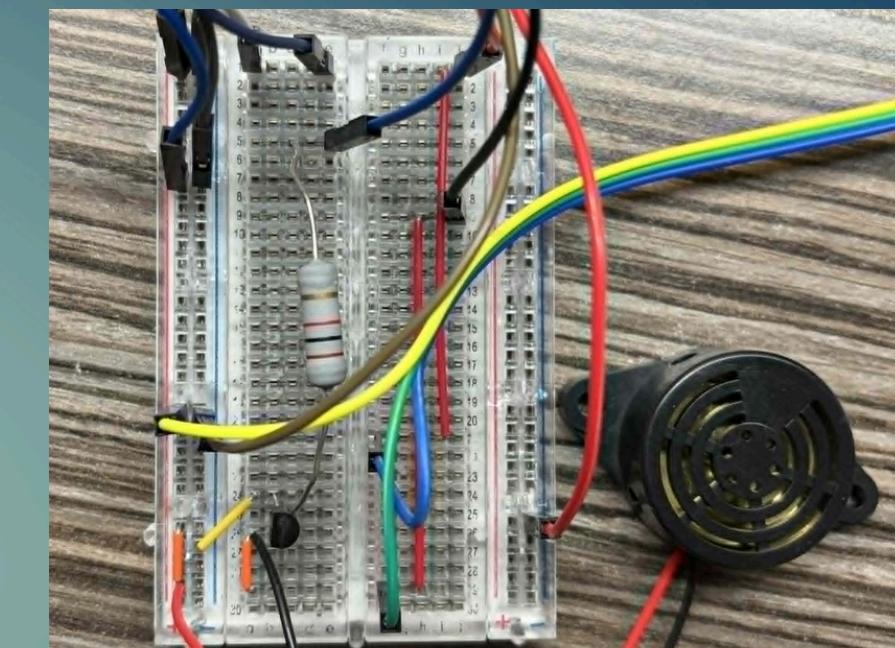
We're  here

Hardware Architecture

- LCD2004(Monitor)

I2C

- SFM-27(95dB Buzzer)
1k resistor and NPN transistor
Prevent short-circuiting the MCU pin



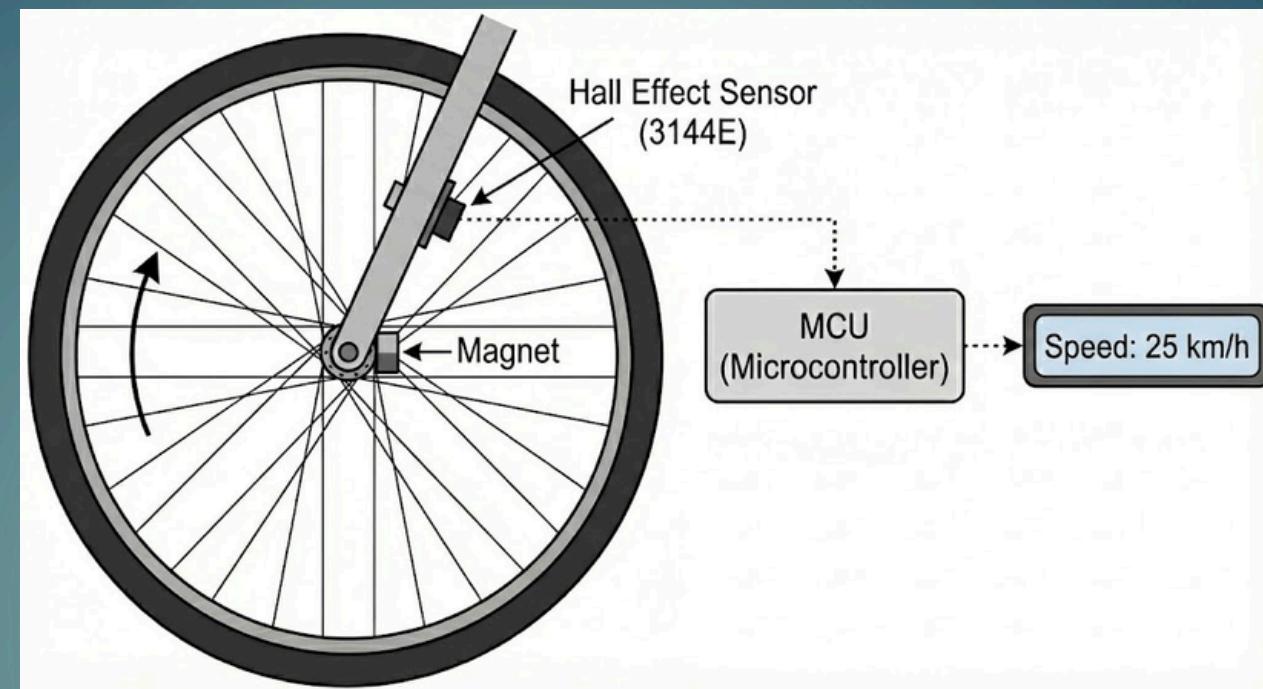
Approach

Hardware Architecture

- Hall Effect Sensor

Neodymium magnet - Hard to detect

周長*週期



Approach

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Approach

Software Logic

- METs Integration

$$\text{METs} \times 3.5 \times \text{Weight (KG)} / 200 = \text{Kcal/min}$$

- Smart Security & Event Logging

Auto-Lock Mechanism

Security Event Logging

Rate Limiting

Approach

Ready, Set, Bike!	METs	Calories per 60 mins*
Stationary cycling, 50 watts	3.0	215
Bicycling, leisurely	3.5	250
Stationary cycling, 100 watts	5.5	395
Bicycling, 12-13 mph	8.0	575
Bicycling, 14-15 mph	10.0	715
Bicycling, 16-19 mph	12.0	860
Bicycling, 20+ mph	16.0	1145

System Layer	Refresh / Sampling Rate
1. Hall Sensor	Real-time (Interrupt)
2. Motion Sensor	50 Hz (Polling)
3. UI Input	50 Hz (20ms)
4. Core Logic	100 Hz
5. LCD Display	1 Hz
6. Bluetooth	1 Hz

Bluetooth

- Lock Control (Write/Notify): 雙向控制。
- Speed/Calorie (Notify): 定期推播。
- History Log (Notify): 批次傳輸。

Timestamp

- Relative Time / Absolute time

Approach

我們的多功能腳踏車鎖BikeLocker能夠綁在腳踏車上運作，主要分為上鎖以及解鎖兩個狀態，並擁有以下功能：

一、上鎖與解鎖切換：

1. 使用者可以按App中的按鈕進行上鎖及解鎖
2. 沒有攜帶手機時，使用者可以利用板子上的藍色按鈕，按出短、短、長的密碼，進行上鎖及解鎖
3. STM上會有燈色顯示當前狀態，作為螢幕顯示損壞時的替代方案

二、上鎖狀態：

1. 手機連線上時，可以用App讓BikeLocker的蜂鳴器發出聲響，提示使用者腳踏車位置
2. 若腳踏車被他人移動，則令蜂鳴器發出聲響警示移動者，並且記錄這些移動的時間，在使用者下次解鎖時，會顯示於App中
3. 上鎖狀態時，會在螢幕中顯示Locked字樣以及上次解鎖時累積消耗的熱量

三、解鎖狀態：

1. 若腳踏車一定時間沒有移動，BikeLocker會自動進行上鎖
2. 在解鎖時，BikeLocker會計算騎乘速度，並且進一步計算累計消耗熱量，顯示於螢幕以及App上

Result

MOTIVATION

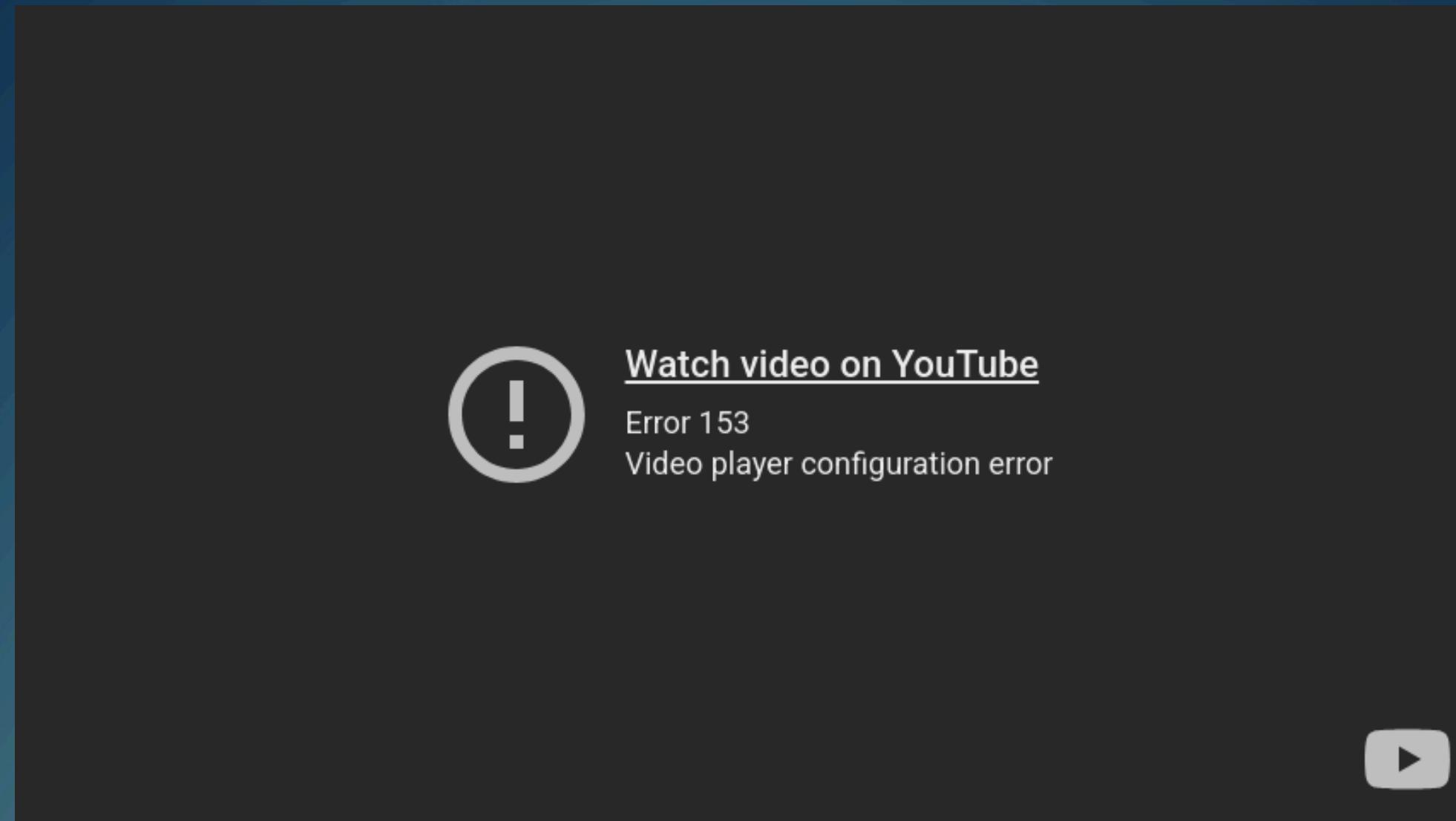
APPROACH

RESULT

REFERENCE

Demo

<https://youtu.be/uPS2nr-1a1U>



Result

- Previous homeworks
- AI tools
- American College of Sports Medicine. **The Compendium of Physical Activities.** ACSM Resource Manual 5th Edition, 2006.

References

THANK YOU