

邊坡監測系統實驗與資料分析

Experience of Slope Monitor System and Data

Analysis

指導教授：張大緯

專題成員：莊程傑

開發工具：STM32CubeIDE1.14.1、Colab

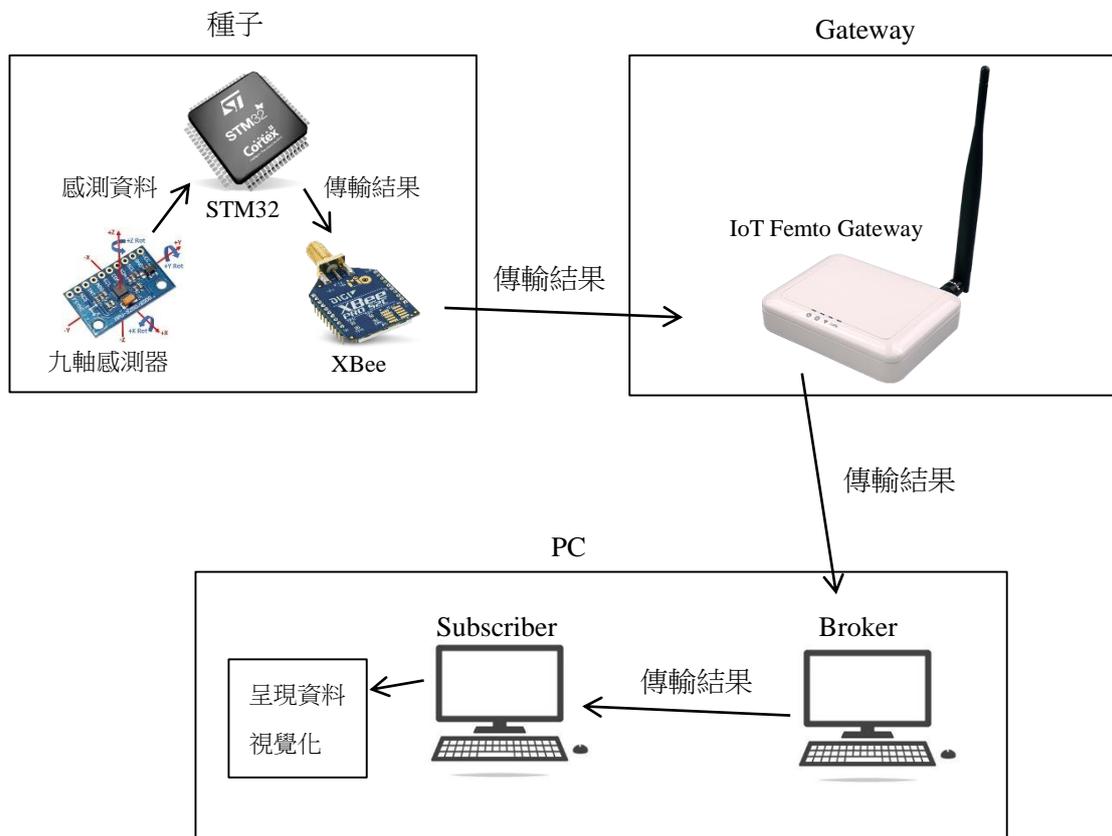
測試環境：Windows 11

一、簡介：

臺灣位於地震帶及颱風密集之地區，然而近年來陸續發生的邊坡崩塌事件，其災害搶救之順暢度與效率仍然是受到檢討之議題。究其原因，偵測災害的感測器遍及率低，無法即時得知災害發生。因此，我想設計且測試一套系統，並利用低成本的感測器對其做滑坡偵測，實驗是否能改善判斷的精準度。

我們首先利用 STM32 搭載 MPU9250 九軸感測器建立一個邊坡種子模組，透過資料濾波以及演算法判斷是否發生滑坡，若判斷成功則將滑坡警報透過 xbee 通訊模組傳至 gateway，再透過網際網路傳至 PC。

以下為系統架構圖：



二、測試結果：

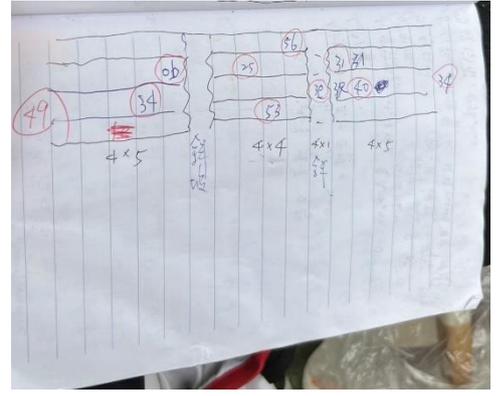
我們首先透過 Mahony 演算法求出物體姿態，得到重力方向，以方便計算位移變化，用來判斷邊坡是否滑落。本次實驗在南投縣仁愛鄉惠蓀林場，且由交管系李威勳老師、測量系郭佩棻老師以及中興大學團隊引領實驗的進行。下圖為實驗照片，種子埋在圖一圖二裡邊坡上標示的格子範圍內，圖三則是當時紀錄每顆種子的位置。



圖一



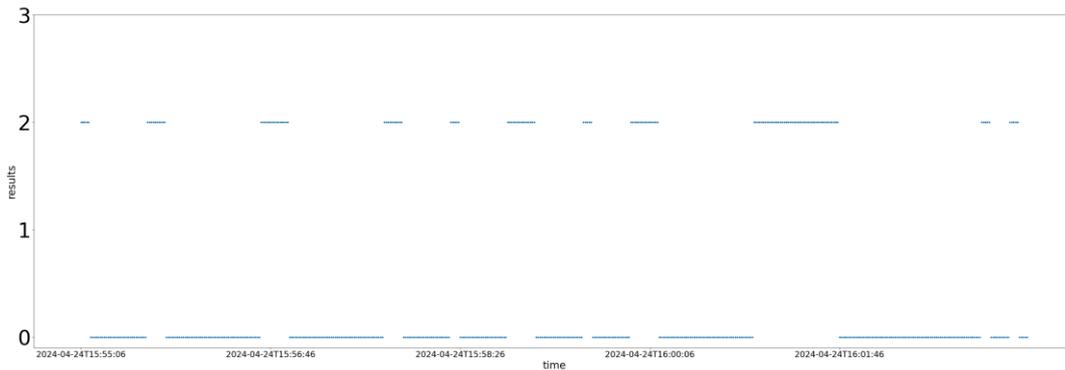
圖二



圖三

```
系統管理員: 命令提示字元
Client null received CONNACK (0)
Client null sending SUBSCRIBE (Mid: 1, Topic: GIOT-GW/UL/82029CF6BD77, QoS: 0, Options: 0x00)
Client null received SUBACK
Subscribed (mid: 1): 0
Client null sending PINGREQ
Client null received PINGRESP
Client null sending PINGREQ
Client null received PINGRESP
AC
E:\Program Files (x86)\mosquitto>mosquitto_sub -d -h 192.168.55.114 -t GIOT-GW/UL/80029CF7BD76 -u admin -P admin
Client null sending CONNECT
Client null received CONNACK (0)
Client null sending SUBSCRIBE (Mid: 1, Topic: GIOT-GW/UL/80029CF7BD76, QoS: 0, Options: 0x00)
Client null received SUBACK
Subscribed (mid: 1): 0
Client null received PUBLISH (d0, q0, r0, m0, 'GIOT-GW/UL/80029CF7BD76', ... (285 bytes))
[{"channel": "923200000", "sf": 10, "time": "2023-03-23T18:03:41+08:00", "gwip": "0.0.0.0", "gwid": "000080029cf50974", "repeater": "00000000ffffffff", "systype": 0, "rssi": -48.0, "snr": 17.5, "snr_max": 30.8, "snr_min": 12.0, "macAddr": "0000000000000014", "data": "7777", "frameCnt": 0, "fport": 1}]
Client null received PUBLISH (d0, q0, r0, m0, 'GIOT-GW/UL/80029CF7BD76', ... (285 bytes))
[{"channel": "923200000", "sf": 10, "time": "2023-03-23T18:04:00+08:00", "gwip": "0.0.0.0", "gwid": "000080029cf50974", "repeater": "00000000ffffffff", "systype": 0, "rssi": -53.0, "snr": 20.0, "snr_max": 31.3, "snr_min": 16.3, "macAddr": "0000000000000014", "data": "7777", "frameCnt": 0, "fport": 1}]
```

圖四：電腦接收資料



圖五：資料視覺化