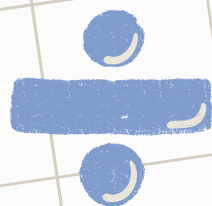


Skate Safe



滑板衝擊監測與
FHIR 健康回報系統
Integrate with FHIR server

講者:王順泰

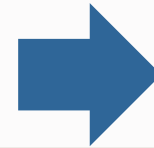
自我介紹

- 大安高工電子科
- 大安滑板23屆副社長
- FHIR大健康S2冠軍



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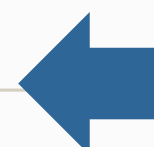
實際流程



核心功能



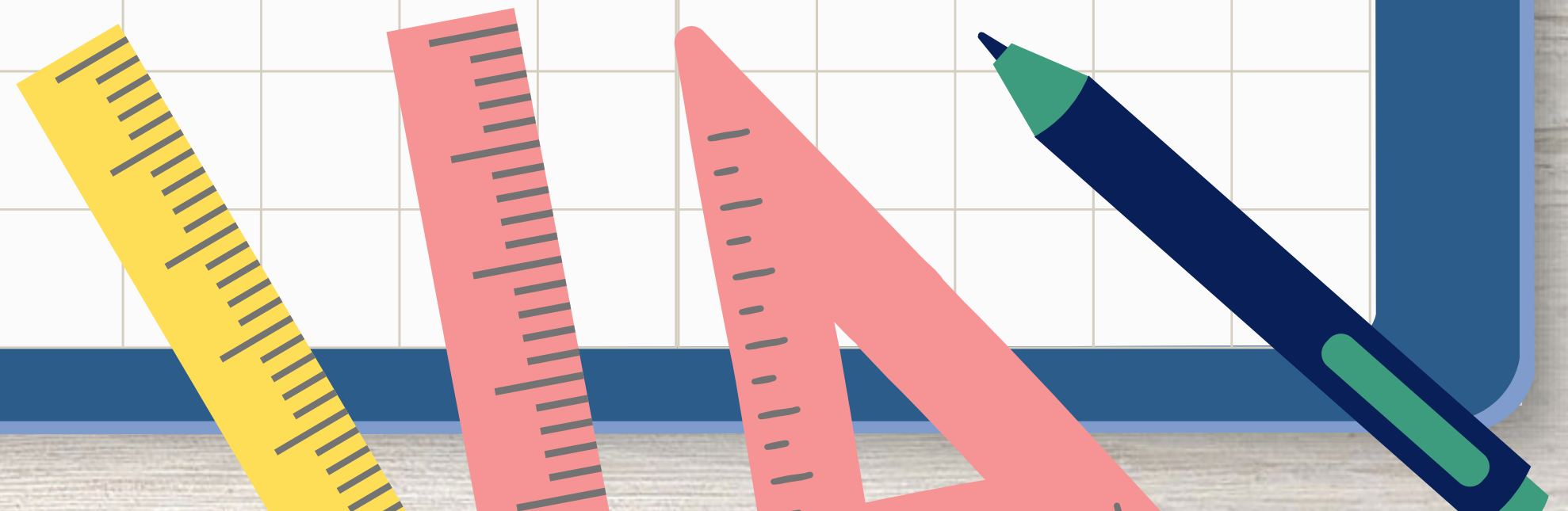
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未來發展

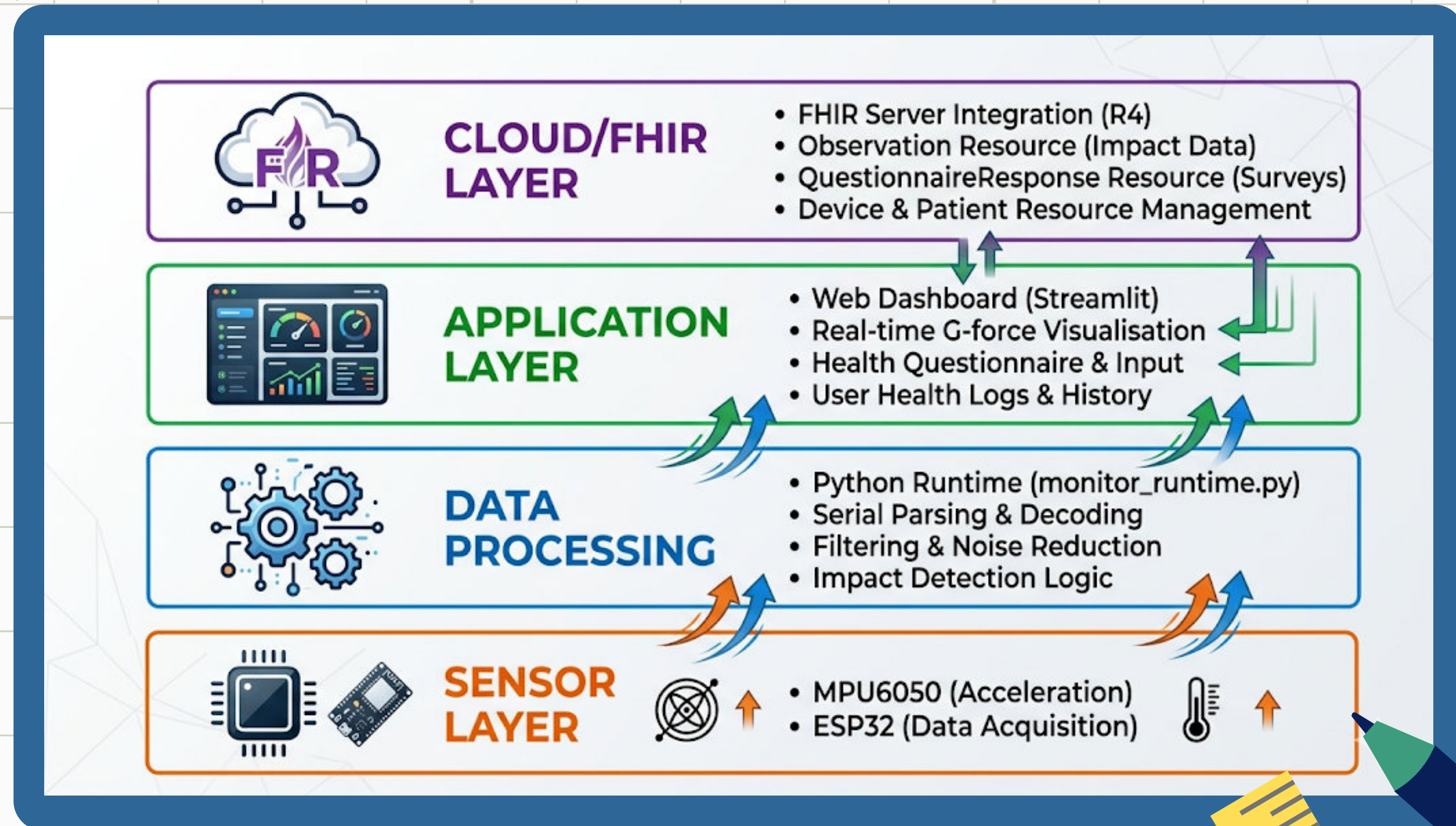


製作動機

- 1 撞擊難以量化
- 2 主觀症狀常被忽略
- 3 資料難以延伸

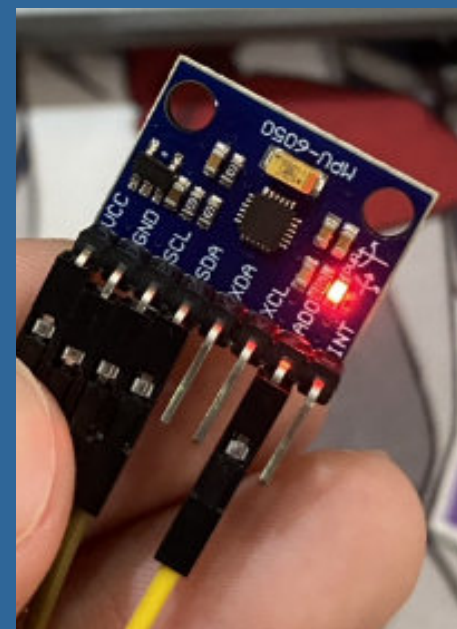


整體架構



實際流程 (硬體層)

開始



MPU6050
加速度感測器

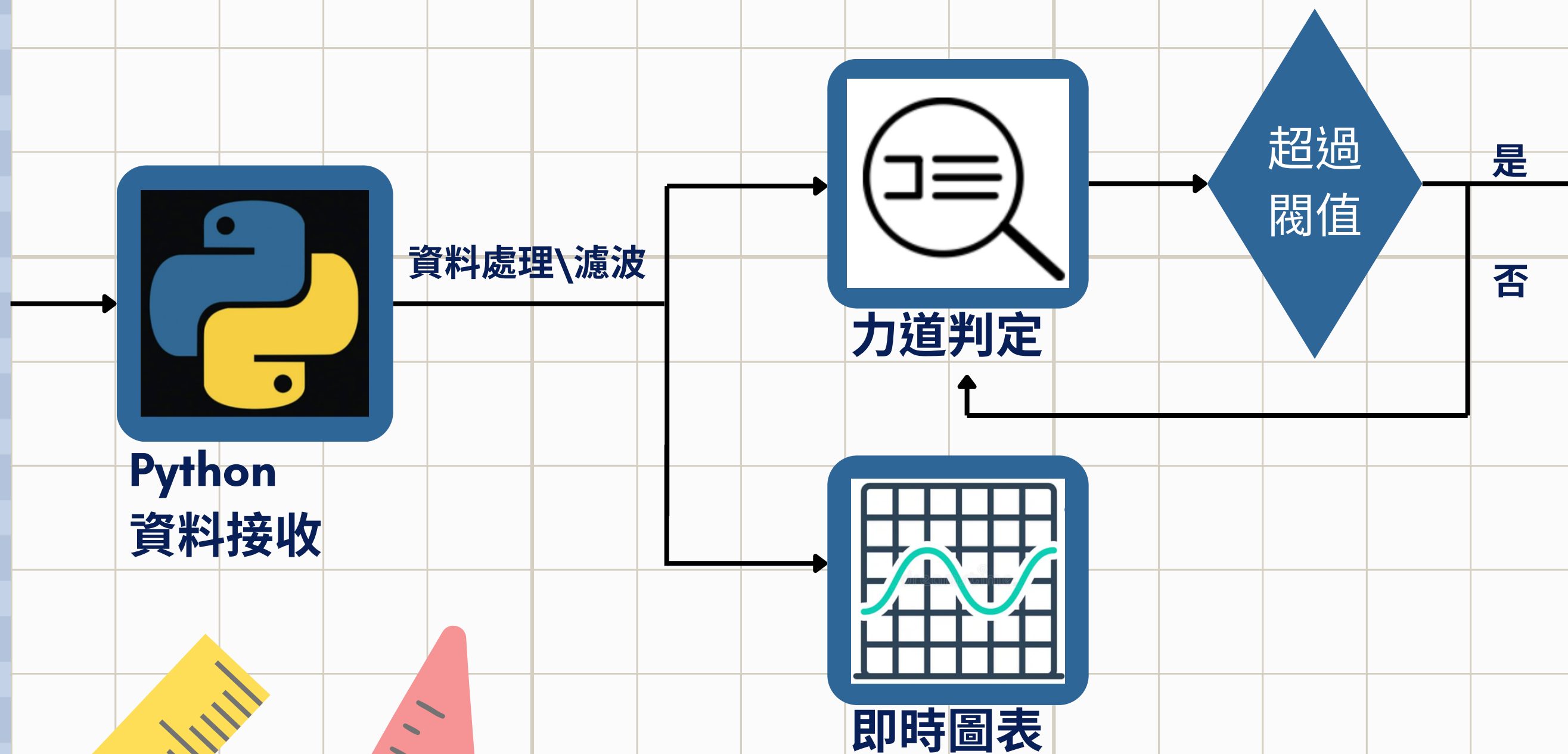
I2C通訊



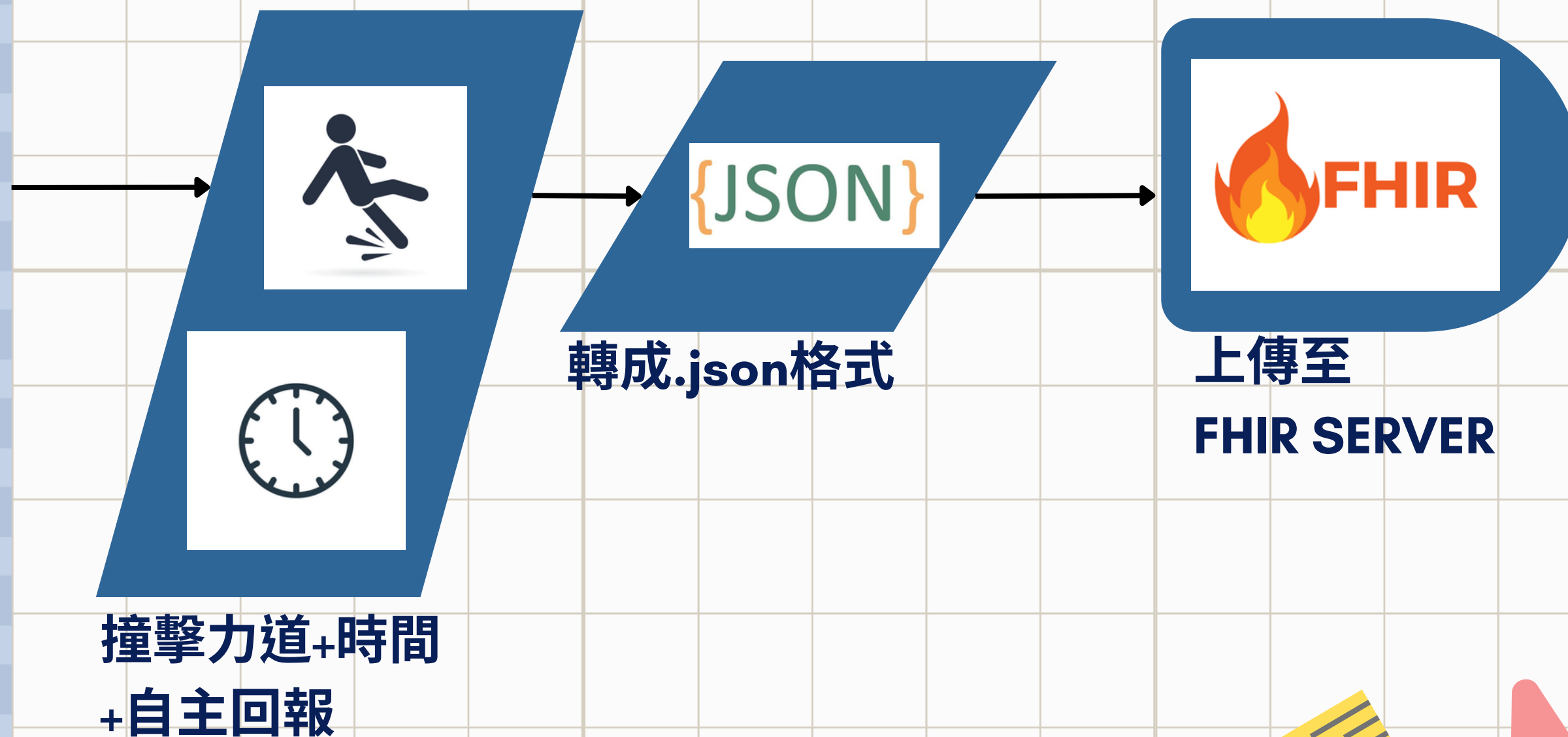
ESP32

USB / 藍芽

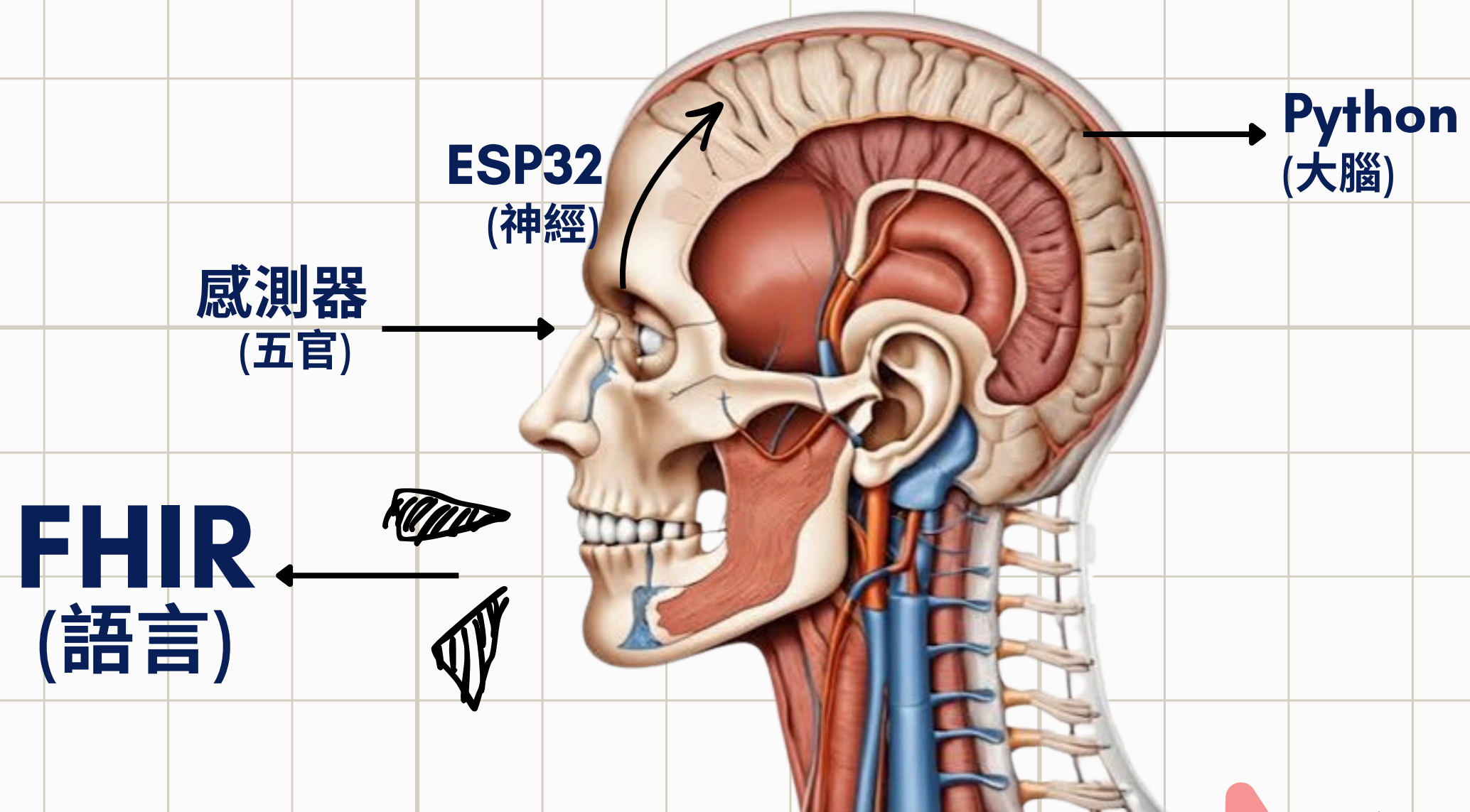
實際流程 (軟體層)



實際流程 (資料層)

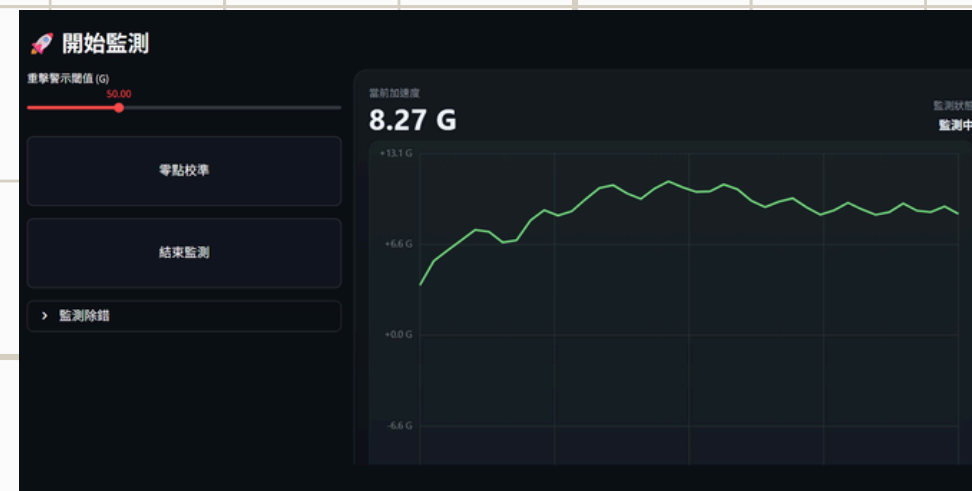


什麼是FHIR?



核心功能

1 開始監測 即時監測衝擊強度



2 健康回報 收集主觀健康資訊

3 歷史紀錄 建立個人健康軌跡

時間	類型	摘要
2026-05-02T12:15:14.777400	重擊事件	偵測到重擊事件
2026-05-02T12:15:14.633978	重擊事件	偵測到重擊事件
2026-05-02T12:15:14.571068	重擊事件	偵測到重擊事件
2026-05-02T12:15:14.380378	重擊事件	偵測到重擊事件
2026-05-02T12:15:14.317237	重擊事件	偵測到重擊事件
2026-05-02T12:15:14.260656	重擊事件	偵測到重擊事件
2026-05-02T12:15:14.214962	重擊事件	偵測到重擊事件
2026-05-02T12:15:14.168559	重擊事件	偵測到重擊事件
2026-05-02T12:15:14.123608	重擊事件	偵測到重擊事件
2026-05-02T12:15:14.062886	重擊事件	偵測到重擊事件

4 上傳雲端 與醫療標準接軌

問題解決

1

自訂即時圖表元件

index.html產生圖表

```
23 let targetHistory = new Array(40).fill(0);
24 let renderedHistory = new Array(40).fill(0);
25 let currentYBound = 4;
26 let targetYBound = 4;
27 let latestValue = 0;
28 let runtimeStatus = "等待資料";
29 let footerText = "";
30 let footerIsError = false;
31 let lastUpdatedAt = "";
32
33 function resizeCanvas() {
34   const ratio = window.devicePixelRatio || 1;
35   const rect = chartWrap.getBoundingClientRect();
36   canvas.width = Math.max(1, Math.floor(rect.width * ratio));
37   canvas.height = Math.max(1, Math.floor(rect.height * ratio));
38   ctx.setTransform(ratio, 0, 0, ratio, 0, 0);
39 }
40
41 function computeTargetYBound(history) {
42   const maxAbs = history.reduce((acc, value) => Math.max(acc, Math.abs(value)), 0);
43   return Math.min(Math.max(2, maxAbs * 1.15), 20);
44 }
45
46 function setStatus(snapshot) {
47   if (!snapshot) {
48     runtimeStatus = "等待資料";
49     footerText = "尚未收到監測資料";
50     footerIsError = false;
51     return;
52   }
53 }
```

SkateSafe_App.py把前端圖表 HTML 組起來

```
803 def build_live_monitor_component_html(server_url, show_debug):
804     template = LIVE_MONITOR_COMPONENT_PATH.read_text(encoding="utf-8")
805     config_json = json.dumps(
806         {
807             "serverUrl": server_url,
808             "showDebug": bool(show_debug),
809         },
810         ensure_ascii=False,
811     )
812     return template.replace("__SKATESAFE_CONFIG__", config_json)
813
814
815 def render_live_monitor_chart_component(server_url, show_debug):
816     if not server_url:
817         st.error("監測圖表端點尚未啟動。")
818         return
819
820     components.html(
821         build_live_monitor_component_html(server_url, show_debug),
822         height=500,
823         scrolling=False,
824     )
825 
```

問題解決

2 背景監測 Runtime

避免感測資料處理與前端頁面生命週期互相干擾

```
752 def handle_runtime_impact(user_id, patient_id, g_force, history_snapshot):
753     log_entry = {
754         "time": datetime.now().strftime("%H:%M:%S"),
755         "g": g_force,
756     }
757     with IMPACT_LOG_PATH.open("a", encoding="utf-8") as log_file:
758         log_file.write(json.dumps(log_entry) + "\n")
759
760     impact_event_entry = {
761         "timestamp": datetime.now().isoformat(),
762         "user_id": user_id,
763         "type": "impact_event",
764         "symptom": "",
765         "note": "偵測到重擊事件",
766         "g_force": g_force,
767     }
768
769     try:
770         append_user_health_log(impact_event_entry)
771     except (OSError, ValueError):
772         pass
773
774     if patient_id and history_snapshot:
775         return json.dumps(
776             export_history_to_fhir_bundle(history_snapshot, patient_id),
777             ensure_ascii=False,
778             indent=2,
779         )
```

```
868 def start_monitoring_session():
869     stop_monitor_runtime()
870     reset_monitoring_state()
871     st.session_state.bg_color = DEFAULT_BG_COLOR
872     runtime = SerialMonitorRuntime(
873         port=st.session_state.selected_port,
874         patient_id=st.session_state.patient_id,
875         user_id=get_current_user_id(),
876         impact_threshold=st.session_state.get("impact_threshold", 50.0),
877         on_impact=handle_runtime_impact,
878     )
879     runtime.start()
880     st.session_state.monitor_runtime = runtime
881     st.session_state.monitor_server_url = runtime.server_url
882     st.session_state.is_monitoring = True
883     st.session_state.has_impact_occurred = False
884     st.session_state.impact_flash_until = 0.0
885     st.session_state.current_g_force = None
886     st.session_state.health_form_expanded = False
887     st.session_state.latest_impact_fhir_json = ""
888     st.session_state.page = "monitor"
889
```

問題解決

3

增量式雲端同步

```
def ensure_cloud_sync_metadata(entry):
    if not isinstance(entry, dict):
        return entry

    cloud_sync = entry.get("cloud_sync")
    if not isinstance(cloud_sync, dict):
        cloud_sync = {}

    cloud_sync.setdefault("uploaded", False)
    cloud_sync.setdefault("uploaded_at", None)
    cloud_sync.setdefault("resource_types", [])
    entry["cloud_sync"] = cloud_sync
    return entry
```

```
284 def mark_log_uploaded(entry, resource_types):
285     ensure_cloud_sync_metadata(entry)
286     entry["cloud_sync"]["uploaded"] = True
287     entry["cloud_sync"]["uploaded_at"] = datetime.now().isoformat()
288     entry["cloud_sync"]["resource_types"] = list(resource_types)
289
```

```
1041 def upload_user_health_logs_to_fhir(user_id, patient_id):
1042     health_logs = load_user_health_logs(show_error=True)
1043     if health_logs is None:
1044         return 0, 0, "無法讀取 user_health_logs.json。"
1045
1046     pending_indexes = [
1047         index
1048         for index, entry in enumerate(health_logs)
1049         if entry.get("user_id") == user_id and not is_log_uploaded(entry)
1050     ]
1051     if not pending_indexes:
1052         return 0, 0, "目前沒有待上傳的本地健康紀錄。"
1053
1054     uploaded_resource_count = 0
1055     uploaded_record_count = 0
1056     error_messages = []
1057     changed = False
1058
```

跨域發展



開發互動感測遊戲



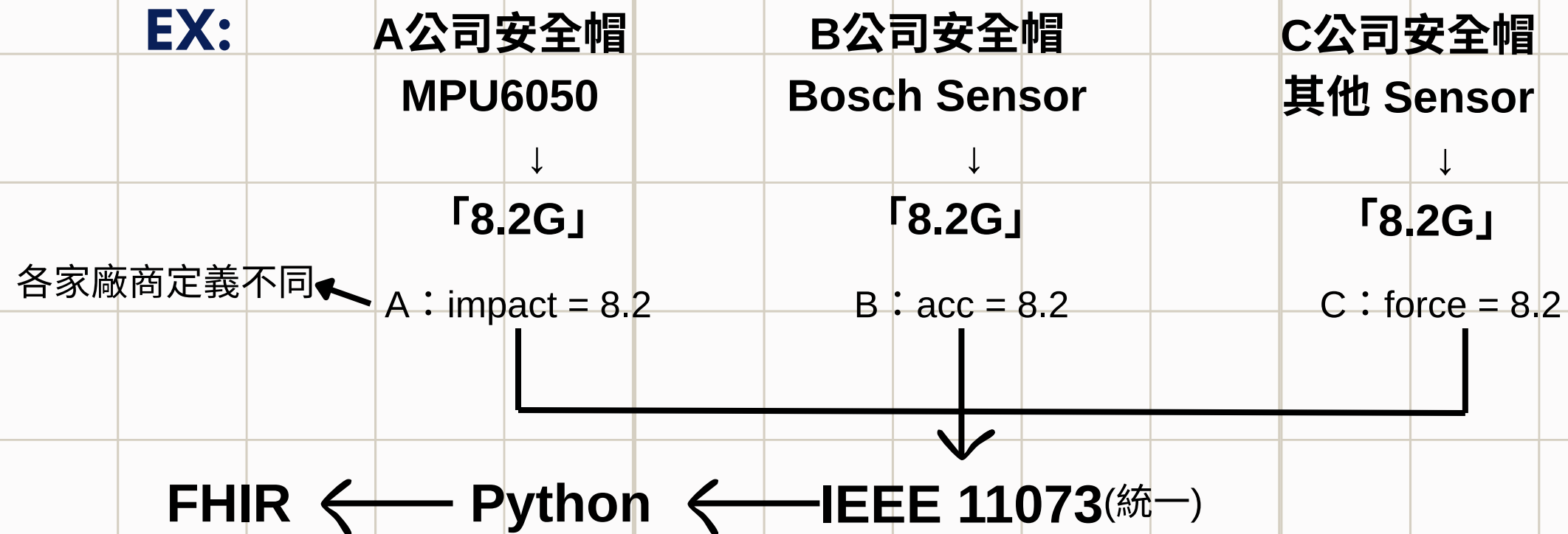
自製感測器作為搖桿
(加速度+紅外線)

未來展望

1 更多樣性的感測器接上FHIR

2 硬體裝置使用IEEE 11073標準

EX:



專題影片



YouTube連結

**Thank
You**

