MONASH University

MONASH ENGINEERING

Faculty of Engineering

ASPIRE Summer Research Program 2026-2027

Project Title: Explaining the Building — An Agentic AI Energy Analyst for Heating Anomalies

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Objective

Develop an on-device agentic AI system that continuously monitors heating and energy data from the MIL smart building's IoT sensors and BMS, autonomously detects abnormal heating behaviour, investigates its likely cause using a digital twin, and generates clear natural-language reports for facilities staff — demonstrating that a small AI model running entirely on local hardware can turn raw building data into actionable, explained insight without cloud dependency.

Project Details

Buildings waste energy in ways that remain undetected within routine BMS data: after-hours heating, simultaneous heating and cooling, sensor drift, and stuck valves. This project develops an on-device agent that monitors this data continuously and reports its findings in clear natural language. The system operates in three stages on a single NPU edge node. At the detection stage, a lightweight anomaly detection model is trained over streaming IoT data (zone temperature, CO_2, occupancy) and BMS heating data (setpoints, valve positions, energy meters), learning the building's normal heating patterns and flagging deviations. At the investigation stage, a small on-device language model responds to each anomaly using defined tools by querying recent BMS history, checking IoT occupancy records, and requesting expected consumption from the DT under the observed conditions with the gap between expected and actual behaviour serving as evidence. At the reporting stage, the agent generates a concise incident summary stating the detected fault, its likely cause, and its estimated energy cost. Evaluation combines detection accuracy on historical testbed data with seeded synthetic faults, together with an assessment of report clarity and usefulness informed where possible by facilities stakeholder feedback.

Project Timeline

TASK	1	2	3	4	5	6	7	8	9	10
Literature review										
Testbed & BMS data exploration										
Develop and train heating anomaly detection model										
Deploy small LM on edge node										
Build expected-consumption DT baseline										
Develop investigating agent with tool access										
Integrated testing with seeded fault scenarios and Evaluation										
Final report and demo										

Prerequisites

Strong Python programming is required, along with enrolment in an engineering, computer science, data science, or related degree. Proficiency with machine learning tools and/or data analytics is desirable.