



1. Introduction

This project focuses on the use of Wireless Sensor Networks (WSN) [1]. Specifically, within an educational based environment. This form of technology is becoming recognised by many industries. Sensor networks contain ‘nodes’ [2] operating on low computing power and energy. These nodes can be tiny in size compared to a larger visible device. Regrettably, a negative with WSNs is their susceptibility to both physical and network connection intrusions. Consideration therefore should be given to the application of the WSN and to the integrity of the data being collected [3]. Currently UWTSD deploys some of these technologies, this project looks to further there application.

2. Project Aims and Objectives

- To demonstrate the operation of a wireless sensor network utilised within a classroom environment.
- Review current technologies
 - Compare previous studies
 - Development of a working simulation of a wireless sensor network utilising the working classroom model
 - Compare results of simulation vs physical model
 - Identify future research

3. Related Work

Four main papers formed the hypothesis for this project, these papers were obtained using IEEE Xplore database, journals and books. The key points of discussion from each paper can be seen below.

1. *This experiment utilised a WSN to monitor student behaviour and used an interactive alert system for lecturers* [4]
2. *The focus for this paper was on the concept and how they got to implementation.* [5]
3. *Embedded web-based solution utilising RFID & ZigBee technologies* [6]
4. *ZigBee & RFID technologies monitoring door access and environment* [7]



Figure 1

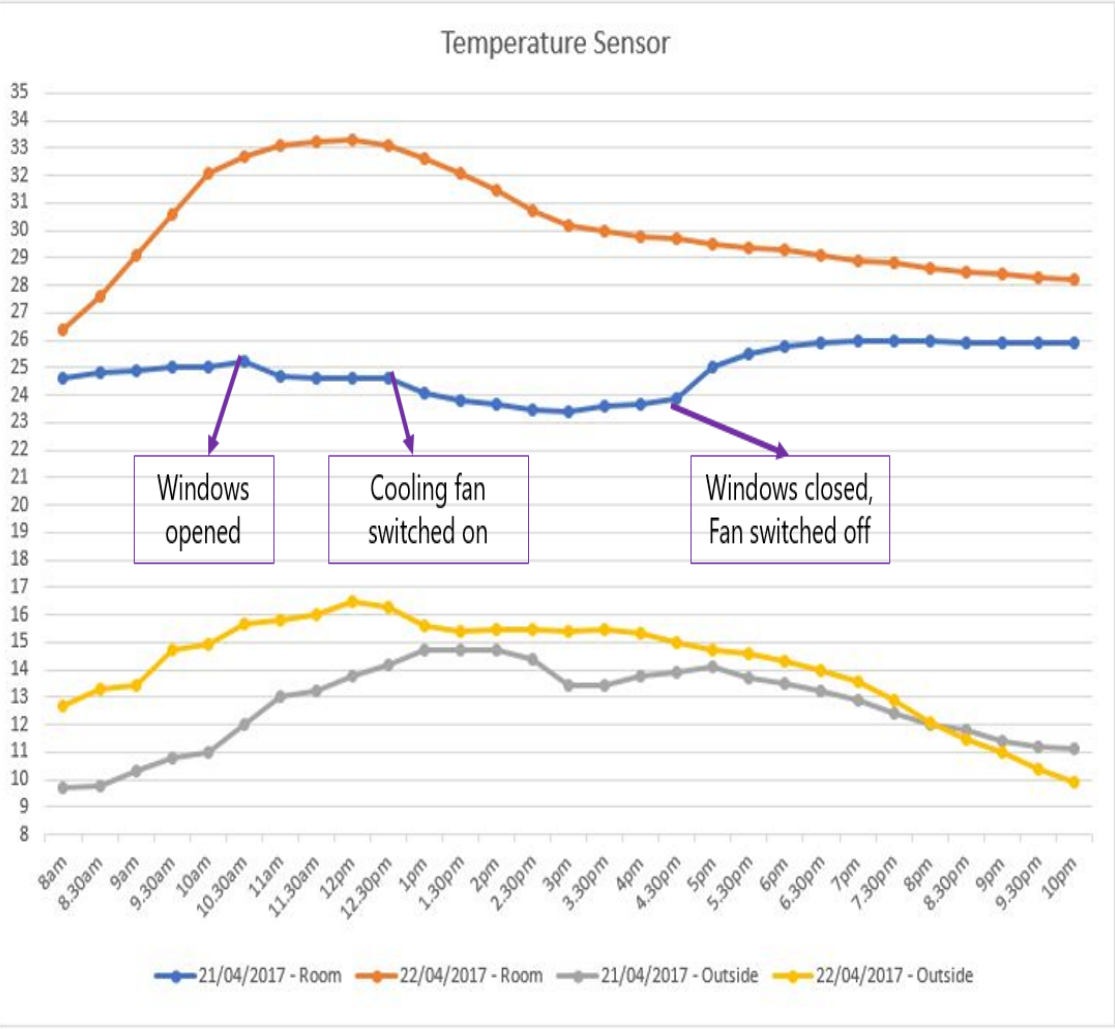


Figure 3



Figure 5 [1]



Figure 6



4. Design and Implementation

This project used Physical & Simulation experiments to produce results for analysis. MH505 in Mount Pleasant Campus is utilised as the model for experiments

Physical devices & hardware installed

- Temp, LUX, Motion, Humidity and Light detection sensors
- Wireless Power over Ethernet (PoE) gateway installed

Simulation devices & hardware implemented

- Utilises the same sensors as physical
- Additional Face detection, CO2, and RFID reader sensor nodes utilised

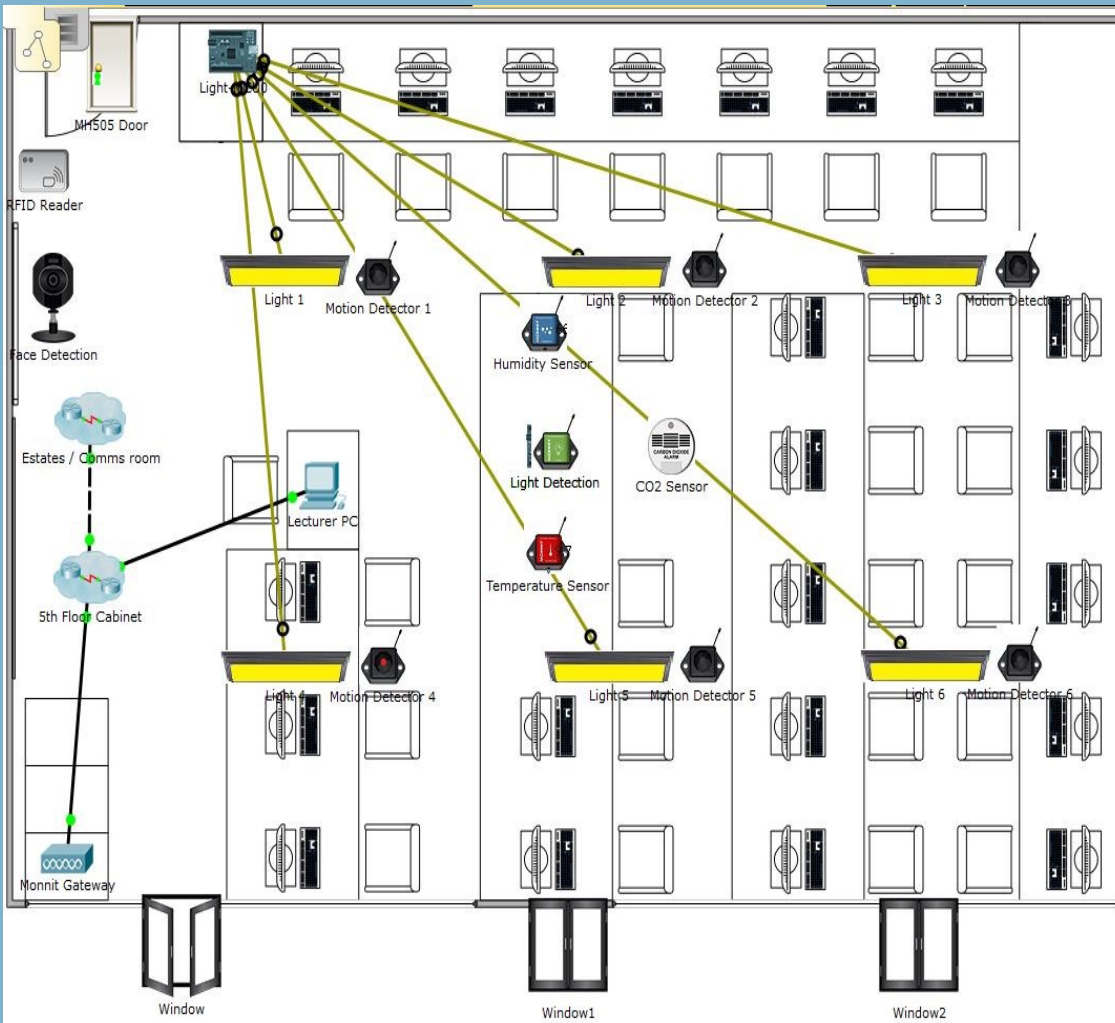


Figure 2

5. Results

The results from the tests completed on the 21st and 22nd April can be seen in figures 3 and 4.

Events identified from testing

- Windows opened, temp recorded at 25.2 °C
- Air cooling turned on, temp recorded at 24.3 °C
- No occupancy, windows closed, and temp increases
- Temperature externally continues to increase
- Highest temperature recorded on 22nd April 33.3 °C
- LUX sensor readings inconsistent with research, expected levels should be at a minimum 300lux.

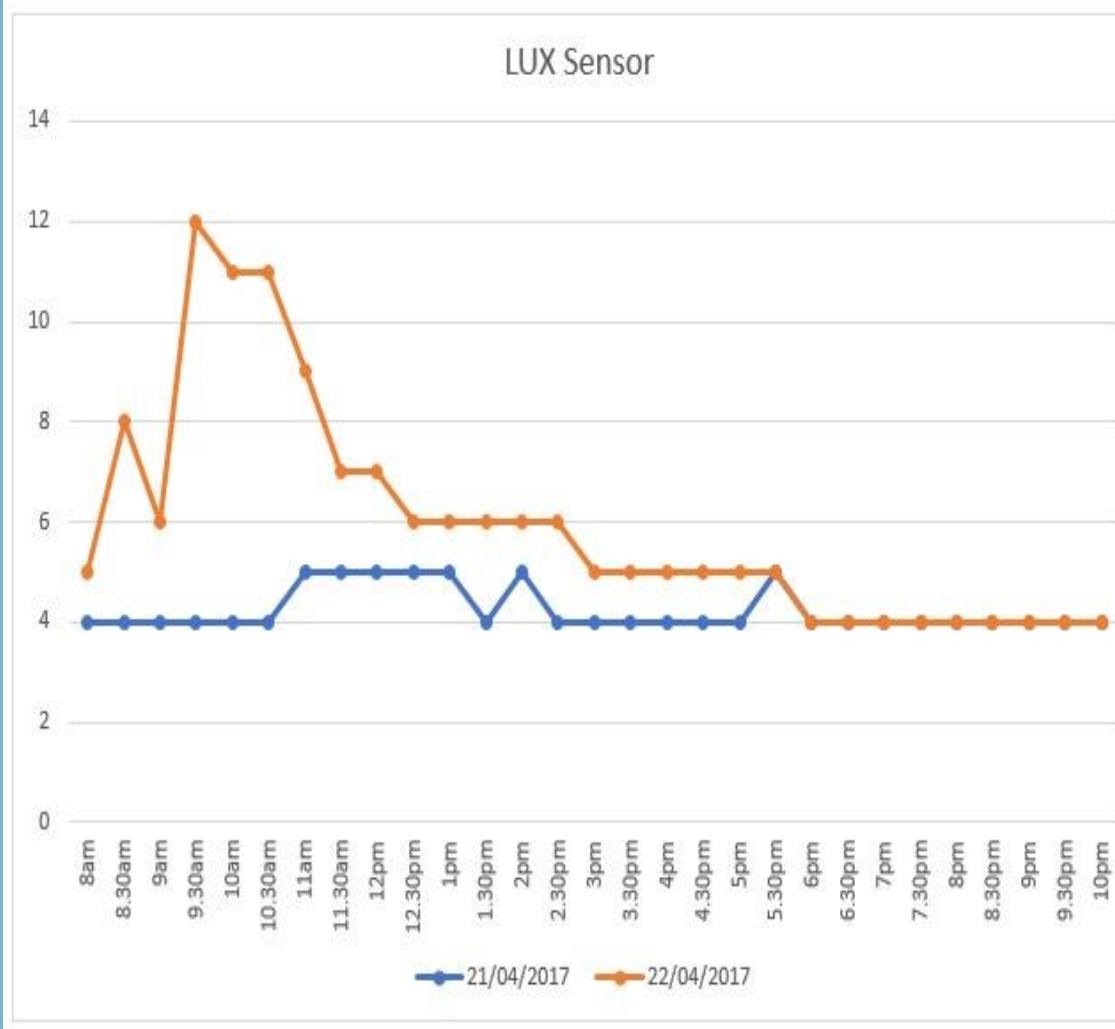


Figure 4

6. Conclusion

This project set-out to demonstrate the operation of a wireless sensor network. In fact whilst the aim has been achieved further objectives have been met and future work was identified.

- Knowledge of 802.11 standards - Bluetooth, ZigBee and Wi-Fi
- Sensor technology available in the marketplace today
- Simulation model created using Cisco Packet Tracer
- A working physical implementation in MH505
- Production of results for analysis

References

1. Opportunities and Challenges of Wireless Sensor Networks in Smart Grid (2010)
2. Simple Wireless Sensor Nodes (2008)
3. Authentication Protocol Design and Low-Cost Key Encryption Function Implementation for Wireless Sensor Networks (2015)
4. An intelligent classroom management system based on wireless sensor networks (2015)
5. Smart Classroom: From Conceptualization to Construction (2014)
6. Application of the ZigBee and Go-Ahead technology in the system of smart classroom (2013)
7. A scalable intelligent room based on wireless sensor networks and RFIDs (2010)