**IoT Full-Stack System for Controlling and Monitoring a Smart Home**

A REPORT SUBMITTED TO MANCHESTER METROPOLITAN UNIVERSITY FOR THE DEGREE OF BACHELOR OF SCIENCE IN THE FACULTY OF SCIENCE AND ENGINEERING



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# Declaration

No part of this project has been submitted in support of an application for any other degree or qualification at this or any other institute of learning. Apart from those parts of the project containing citations to the work of others, this project is my own unaided work. This work has been carried out in accordance with the Manchester Metropolitan University research ethics procedures and has received ethical approval number 2020-26247-20539.

Signed:

# Acknowledgments

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# Abstract

The aim of this project is to design and develop a full-stack system capable of controlling and monitoring a smart home. This was done by creating an Android application capable of enabling a user to control and monitor smart home devices, a client which is connected to the devices and is capable of sending and receiving information between itself and the Android application, a database on which a user’s account information and currently active smart home devices are stored, and also an application programming interface to allow the Android application to communicate with the database. The project was successful as the application developed allowed a user to control and monitor several kinds of smart home devices effectively.

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Figure 1: “The things home automation can do” (Source: Diy Doctor, 2020: online).

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# Abbreviations

IoT Internet of Things

MQTT Message Queuing Telemetry Transport

PC Personal Computer

API Application Programming Interface

SQL Structured Query Language

JS JavaScript

TCP/IP Internet Protocol Suite

USB Universal Serial Bus

CTRL F CHECK THESE ALL EXISTS

# 1 Introduction

## 1.1 Project Background

Smart home automation systems have become increasingly common in the last decade due to the arrival of the Internet of Things (Ali et al., 2020). The Internet of Things is an “interconnection of sensing and actuating devices providing the ability to share information across platforms through a unified framework, developing a common operating picture for enabling innovative applications. This is achieved by seamless ubiquitous sensing, data analytics and information representation with Cloud computing as the unifying framework.” (Gubbi et al., 2013:1647) for IoT to be able to connect such a large number of devices it needs to have a flexible and layered architecture, the most basic model of IoT consists of a 3 layer architecture which includes the Perception, Network and Application layers (Choudhary and Jain 2016).

There are many different applications of IoT including wearables, agriculture, smart grids, hospitality, connected health, smart cities and more, but this project will be focused on its smart home automation applications. A smart home system is normally made up of IoT devices such as cameras, sensors, actuators, and appliances that can be accessed remotely (Rizvi et al., 2018) as shown in Figure 1 below.

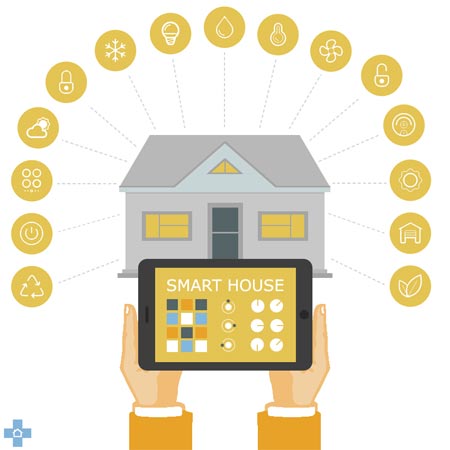


Figure 1: “The things home automation can do” (Source: Diy Doctor, 2020: online).

For IoT devices to be able to transmit data over a network they need to use a certain protocol, the main protocol that will be used in this project is MQTT which is very lightweight and usually runs over TCP/IP and uses a publish/subscribe concept to transfer information through a broker.

The aim of this project was to create a full-stack system that allows a user to control or monitor smart devices within their home, the system must be affordable, efficient, and easy to use. The smart home devices used in this project are all Phidget devices which are inexpensive electronical components and sensors which can be connected to a PC via a USB connection. The project is made up of four main components: A React Native Android application, a JS API, a MySQL relational database and a Java PC client. The Android application provides a user interface enabling a user to add their Phidget devices to the system and monitor/control the added Phidget devices. The Android application can communicate with a database via the API, the database used is a MySQL relational database running on the university’s ‘mudfoot’ server. This database can contain a user’s account information and connected Phidget devices, this means the system can support multiple users. The client runs on a computer that has all the Phidget devices connected to it, the Android application can communicate with this client through an MQTT broker, meaning that any devices connected can be controller or monitored.

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# Appendices