# Integrated Smart Home Model:
## An IoT Learning-Inspired Platform

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## ABSTRACT

Today, in the realm of Industry 4.0, vastly diverse internet of things (IoT) technologies are integrated everywhere, not to mention included in academic programs in schools and universities. Domain ratio of the final year projects in Universiti Teknologi MARA exposes a staggering hype in IoT as compared to other domains despite not having IoT included in any of the courses. Meanwhile, to fulfill the needs of the student in exploring this technology, an integrated IoT learning platform is developed. It integrates an IoT smart home model and a web-based interface as a learning platform to inspire hands-on learning for the students. The raspberry pi, motion sensor, analog gas sensor, atmospheric sensor, ultrasonic proximity sensor, and rain detector sensor are integrated together in a Lego-built smart home model where its connectivity and readings are displayed in a simple web interface to enable and inspire learning. A manual to set up the entire model is also prepared as a guide for students to set up and further explore the functionalities and operabilities of "things."

## KEYWORDS

Analog Gas Sensor, Atmospheric Sensor, Internet of Things, Motion Sensor, Rain Detector Sensor, Raspberry Pi, Sensors, Ultrasonic Proximity Sensor, Web-Based System

## INTRODUCTION

The Internet of Things (IoT) has been through and is still going through a technological revolution that enables ubiquitous interaction between objects or "things", people and the surroundings. Data are collected by embedded sensors and actuators, which are then sent to dedicated applications to be processed into information for further actions to be taken (Bagheri & Movahed, 2016). According to Gartner forecast, IoT will be embedded in 95% of devices in 2020 ("Gartner Predicts 2018 | Information Technology Predictions," n.d.). As real as the hype on IoT, it is definitely trending in many domains today such as military, agriculture, architectural development, healthcare, transportation and including education. It's a technology that not only is vast influencing how the millennial live but also how they study (He, Lo, Xie, & Lartigue, 2016; Koshy, Shah, Dhodi, & Desai, 2017). In line with this trending technology, the education sector should be at par in providing the facilities to equip the students especially to those study in the field of Information Technology (IT) (He et al., 2016; Raikar, Desai, & Naragund, 2017; Suduc, 2018).

UiTM has yet to have an Internet of Things (IoT) platform of its own, and students are not exposed to this trending technology. Students undertaking Data Communication and Networking and

Netcentric Computing programs learn about the interconnection of an internet in TCP/IP, network design and network administration courses, though have inadequate knowledge about IoT since no specific theoretical or practical content are included in the programs' syllabus just yet. However, a survey of students' interest in the core domains of these two courses shows a trending, inclining interest in IoT related projects as compared to other domains such as computer networking, computer and network security, mobile-based applications, web-based systems and others, whereby a staggering 60% of students enrolled in these courses had chosen IoT based projects as their research or work domain in their final year project.

Adequate facilities and academic material and content are provided both physically and virtually though hardware and software for supporting the teaching of networking, however limited to only the traditional wired and wireless client-server setup and operation. For years before the era of IoT, students were only mastering the knowledge and skills of managing the for mentioned networks and not the knowledge of and skills of managing IoT networks. This includes the knowledge and practical skills of how microprocessors such as Arduino or Raspberry Pi platforms work in terms of its physical board and other hardware, the libraries and the integrated development environment (IDE), integration and communication with other sensors, software or applications. Students should also be provided with the knowledge on how to program these microprocessors via C or C++ code and how to access the pins on the board via the software to control external devices. This also includes integration with other systems, databases and the cloud for storage purposes. Apart from these possible integration or extension of the technology, IoT security is also an essential inclusion to the research field relating to IoT.

The inability to interoperate IoT with the traditional client-server network is a limitation to the knowledge and skills of networking students. Students need to practice with the concept of IoT so that they practically know how the connection between the devices and the hardware is being realized. Nevertheless, it is also comprehensible that in order to set up a platform in a form of space and equipment, not to mention the paperwork, budgetary, procedures, time and cost; are the main hurdle in achieving this aim. Hence, to compensate with time and cost, in providing the students the equipment and the platform for IoT learning purposes, this 'Smart Home' model serves as a platform for students to learn the basic foundation of IoT, the functions of the sensors, the set up and connectivity of circuitry, communication between sensors and microprocessor, system and web integration, etc.

## SMART HOME MODEL

In every perspective, IoT solutions are growing increasingly to virtually all area of everyday lives as the field of an application IoT technologies and as they are tremendously dynamic and diverse. In an IoT environment, many of the things surrounding us gather information about us without our realizing it. Such as things embedded into objects, worn on our bodies, controlled with sensors, developed for intelligence, and created for data gathering capacity and communication. All these things communicate each other through the cloud, make decisions, and shared information. This kind of phenomenon can be created and integrated into a learning tool for learning purposes. For example, many researches uses smart home model and applications as a learning platform for IoT (Alaa, Zaidan, Zaidan, Talal, & Kiah, 2017; Suduc, 2018; Wortmann & Flüchter, 2015). An IoT smart home network mainly consists of physical devices that provide electronic sensors, software, and network connectivity inside a home (Alaa et al., 2017). People used to manually use all everyday things especially home appliances such as lamp, fan, television, bicycle and etc. People can rest more than before as the IoT concept will do everything that refers to the network interconnection of everyday objects generally (Xia, Yang et al. 2012).

A definition by Satpathy states; "a home which is smart enough to assist the inhabitants to live independently and comfortably with the help of technology is termed as smart home. In a smart home, all the mechanical and digital devices are interconnected to form a network, which can communicate

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