Assessment Cover Sheet

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ASSESSMENT DETAILS

Unit title	IoT Programming	Tutorial /Lab Group	Tutorial 2	Office use only
Unit code	SWE30011	Due date	26 March 2021	
Name of lecturer/tutor	Dr. Mark Tee Kit Tsun			
Assignment title	Assignment 1 - Survey paper			Faculty or school date stamp

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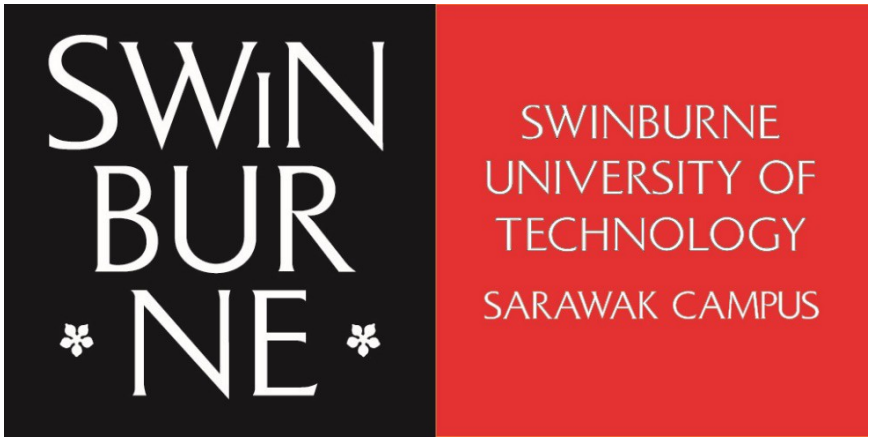

SWE30011 IoT Programming

Semester 1 2021

Assignment 1 – Survey Paper

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Table of Contents

What is IoT?

Different definitions for IoT

There are different definitions for IoT and below are examples of the different types of definitions by various authors.

According to Oracle (2020?) the Internet of Things consists of a network of physical objects that are planted with software or sensors which are used to connect and exchange data with different systems, devices, or hardware through the internet.

Patel, Patel, Scholar & Salazar (2016) states that the Internet of Things is a type of network to connect different hardware or devices with the internet using stipulated protocols or sensing equipment to communicate and exchange information or data with each other.

However, according to Ranger (2020) the Internet of Things can also be defined as billions of different types of devices that exists all around the world that are connected to the internet and all these devices are constantly collecting and sharing data with one another through the internet.

The Internet of Things is also defined as a network of interconnected computing devices, mechanical and digital machines, devices, animals or people that are given unique IDs (UIDs) and are a capable of exchanging information with one another over a network without the need for human-to-human or human-to-computer interaction (Gillis 2020).

Comparing the definitions

The definitions provided by Oracle (2020?) and Patel, Patel, Scholar & Salazar (2016) are quite similar to each other as both definitions stated that IoT is a network of devices that are implanted with sensors or software and are connected with one another through the internet. This enables the devices to be able to communicate and exchange information with one another regardless of locations.

Ranger (2020) shared a common understanding towards the definition of IoT with Gillis (2020) by defining IoT as different types of devices connected through the internet and are able to collect and exchange data with one another through the internet but the difference is that Gillis (2020) stated that each IoT devices are given a unique ID and these IoT devices are able to exchange data with one another without the need for any human or machine intervention.

Personal Definition for IoT

The Internet of Things is comprised of groups of various devices that are connected to one another through the internet and have the capabilities to collect and exchange data to provide useful information for developers so that the data collected can be used to improve daily quality of life for the users.

Ways to increase the awareness on IoT

- Teaching facilities like schools or universities can invite IoT professionals to host talks or workshops to help promote the idea of creating new IoT devices that can be beneficial to society in students by teaching them how to create simple IoT devices.
- Talks regarding the benefits of IoT should be hosted in the open or public so that people not involved in the industry or the general public can learn more about IoT and how it can help to improve their daily lives.
- Tech companies can host annual talks on how IoT is a rising trend in the tech industry and how IoT can be beneficial in projects like using IoT to collect data from a project site that is far from the company.
- Exhibitions or talks can be hosted to showcase several IoT projects and explain how IoT works to both the people who are involved and not involved in the tech industry. These talks can also be used to explain how implementing IoT in the different industries can increase efficiency in production and at the same time help to cut cost.

IoT Applications

Background

One of the more popular area that IoT is used in would be in smart homes where these IoT applications are used to help monitor the health and safety of elderly people that are living by themselves. A smart home can be defined as devices in a home that are connected to each other through the internet where the users are able to remotely manage and track these devices (Shea 2020). This is particularly useful for the disabled and elderlies in cases of emergency where through a push of a button, they can notify the appropriate authorities of their current emergencies.

Issues

One of the issues with implementing such applications would be these elderlies are more vulnerable to hackers where the hackers can gain access to their medical devices like a heart-rate monitor that are connected to the internet and giving the hackers access to their personal medical record. The hackers can steal and sell this information or even modify it which can cause harm to the elderly people or even worse the hackers can insert a ransomware virus and hold these medical records hostage until the amount they requested are paid (Intellectsoft 2020).

Another issue would be the cost to implement these applications. Sheldon (2019) stated that the initial cost to develop an IoT device for healthcare purposes is a significant amount but also stated that the pros would outweigh the cons. However, considering that the elderly people are living alone some might only have enough to survive so to be able to implement it into their smart home system might add increase their financial burdens.

Data overload and accuracy is also one of the issues when implementing these applications. Nasrullah (2020?) stated that IoT devices gather a huge amount of data like health readings from the elderly and send it over to the doctors who are responsible for interpreting these data. If the doctors are not properly trained or equipped to derive useful insights from these huge amount of data, it would be extremely difficult for the doctors to make a decision for their patient thus decreasing the quality of health care provided to the elderly.

Real-World Applications

Heart-Rate Monitor

In a project conducted by Wijesinghe (2020), the author proposed a remote heart-rate monitor using a pulse sensor and all the data collected will be sent to the ThingSpeak platform for storing and managing. The pulse sensor will detect the heart rate pulses whenever the elderly hold the sensor between their fingertips and the heart rate pulses will be sent to the ThingSpeak Viewer app which can be remotely accessed by caregivers in charge of the elderly. Through this app, the caregiver can keep an eye on their elderly without having to be in the same room or area.

Advantages

- Does not cost much to develop this IoT solution as it uses low-cost IoT tools.

Disadvantages

- Does not give a consistent heart rate reading as the elderlies need to constantly hold the sensor between their fingers.

Fall Detection system

In a research paper written by Mrozek, Koczur & Malysiak-Mrozek (2020), they proposed a solution to help detect whether an elderly has fallen by using a mobile device that is equipped with an accelerometer to measure the acceleration and a gyroscope to measure the angular velocity of the device. The mobile device has an application called Whoops to retrieve data from the sensors and transmit them to a data center. Based on the data received, the application can automatically call an emergency service based on the elderly monitored conditions or the elderly can click on a button on the Whoops application to call an emergency service.

Advantages

- Makes it easier for the elderly to contact an emergency service through a push of a button.

Disadvantages

- The elderly must have the smart phone with them the whole time.
- Takes some time to teach an elderly on how to use the application as most elderlies are not technology savvy.

Panic Button

Based on the product developed by Develco Products, it is a wireless and water-resistant panic button that uses Zigbee 3.0 to communicate with edge devices. The elderlies can wear this panic button around their wrist, neck, held in their hands or hanged on a wall like in their kitchen or bedroom. Elderlies living alone can contact emergency services whenever they are in an emergency by pressing the panic button and this can be done anywhere in their home since the panic button is wireless thus making it safer for the elderlies.

Advantages

- The panic button can be worn in showers where accidents occur frequently since it is water-resistant.

Disadvantages

- Battery life is limited to 5 years so needs to be changed every 5 years.

Glucose Monitor

Based on the research paper written by Valenzuela, Garcia, Ruiz & Vazquez (2020), they proposed an IoT solution to monitor the glucose level in a patient or elderlies by measuring the glucose level using a traditional glucometer which is connected to an IoT device like the NodeMCU which has wireless connection capabilities. The reading sent to the IoT device will then be sent to a server like the Raspberry Pi where the data is stored and processed. The processed glucose level will then be shown on a web page for caregivers or doctors to look at and make decisions for the elderlies based on the readings.

Advantages

- Doctors and caregivers can monitor the elderly's glucose level remotely without having to be in the same room as the elderlies.

Disadvantages

- Elderlies will need to prick their fingers with the glucometer periodically to obtain the glucose reading which might be uncomfortable for them.

Suggestions for improvements

- For the glucose monitor instead of using a traditional glucometer, a glucose sensor in a form of a patch might make it easier and more comfortable for the elderlies to obtain their glucose level.
- For the heart rate monitor, make the pulse sensor wearable on the wrist so that it is possible to collect the heart rate reading continuously instead of only when the elderlies put the sensor between their fingers.
- For the fall detection system, put the sensors around the elderly's waist instead of a mobile device so that even without the mobile device, emergency services are notified when the elderly have not clicked the "I am Okay button" on the mobile device after a certain amount of time.

Preparing for Prototyping

The proposed IoT solution is for heart-rate monitoring where the pulse sensor which is an IoT device is connected to an edge device like a Raspberry Pi and the data collected in the edge device will be sent to the cloud service in this case ThingsSpeak for data analyzing. The pulse sensor is attached to the user's wrist to obtain the pulse rate and then the data collected will be sent and stored in the edge device which is connected to the internet. The stored data will then be sent to the cloud where the data will be analyzed and shown on a web page for caregivers or doctors to look at.

Raspberry Pi

Description

Raspberry Pi is a cheap device with functions like a computer with the size of a credit card. (*What is a Raspberry Pi?* c.2020)

Different models:

- Raspberry Pi Model A
- Raspberry Pi Model B
- Raspberry Pi Compute
- Raspberry Pi Zero

What is it used for?

Raspberry pi is used for discovering new things in computing and learning how to program in different programming languages like Python. (*What is a Raspberry Pi?* c.2020)

Tutorials

Tutorial website	Ease of understanding	Amount of content	Additional links to learn more
1) **https://projects.raspberrypi.org/en/projects/raspberry-pi-getting-started**	Easy to understand as it provides simple yet detailed and step by step instructions.	Images and GIFS are provided to help understand the components better.	No links provided
2) **https://realpython.com/python-raspberry-pi/**	Not easy to understand as it tries to cramp so many things in one page	Images are provided to help understand the components better	Links to more tutorial or information about components are provided
3) **https://pythonprogramming.net/introduction-raspberry-pi-tutorials/**	Takes some time to understand as it contains a lot of text and reading to go through	Images are provided to help understand the components better.	Links to different projects and Youtube tutorials are provided.

Verdict:

The tutorial that I would choose would be the first tutorial because it is really easy to understand as the tutorial are separated into different pages instead of cramping into one page and visually it is less of an eye sore as compared to the other two tutorials.

Arduino

Description

Arduino is an open-source platform that is commonly used for building electronic projects. (*What is an Arduino?* c.2020)

Different models:

- Arduino Uno (R3)
- Lilypad Arduino
- RedBoard
- Arduino Mega (R3)
- Arduino Leonardo

What is it used for?

It is used for building electronic projects for both beginners and advanced users where they can write a line of code into the microcontroller to make the circuit function like lighting an LED.

Tutorials

Tutorial website	Ease of understanding	Amount of content	Additional links to learn more
1) **https://learn.sparkfun.com/tutorials/what-is-an-arduino/all**	Takes some time to understand as it contains a lot of text and reading to go through	Images are provided to help understand the components better.	Links to more tutorial, projects or information about components are provided
2) **https://www.tutorialspoint.com/arduino/arduino_overview.htm**	Easy to understand as it provides simple yet detailed and step by step instructions.	Images are provided to help understand the components better.	No links provided
3) **https://www.makerspaces.com/arduino-uno-tutorial-beginners/**	Takes some time to understand as it contains a lot of text and reading to go through	Images are provided to help understand the components better.	Links to different projects and Youtube tutorials are provided.

Verdict:

The tutorial that I would choose would be the third tutorial because even though it will take some time to go through the materials, it does provides links to Youtube tutorial videos which helps me to understand better and also provides links to different Arduino projects for me to look at.

NodeMCU

Description

Arduino is an open-source firmware with built-in WiFi chip. (*Introduction to NodeMCU* c.2019)

Different models:

- V1 (version 0.9)
- V2 (version 1.0)
- V3 (version 1.0)

What is it used for?

It is used for building IoT products.

Tutorials

Tutorial website	Ease of understanding	Amount of content	Additional links to learn more
1) **https://tttapa.github.io/ESP8266/Chap08%20-%20mDNS.html**	Not easy to understand, contains a lot of texts.	No Images provided.	No links provided.
2) **https://electropeak.com/learn/nodemcu-esp8266-on-arduino-ide/**	Easy to understand.	Images are provided to help understand the components better.	Links to different projects provided.
3) **https://www.instructables.com/Programming-ESP8266-ESP-12E-NodeMCU-Using-Arduino-/**	Easy to understand	Images are provided to help understand the components better.	Links to different projects and Youtube tutorials are provided.

Verdict:

The tutorial that I would choose would be the third tutorial because it is easy to understand but the difference between second tutorial would be it provides a Youtube tutorial video which helps it easier for me to understand and also it provides links to different components used in the tutorial in case I want to learn more about them.

XBee

Description

XBee is a radio communication module that acts as a transceiver and receiver developed by Digi International.

Different models:

- XBee 3 Pro
- XBee Pro 900
- XBee Pro 900 XSC
- XBee 3
- XBEE 1mW U. FL Connection – Series 1

What is it used for?

It is used to allow wireless communication between different IoT devices.

Tutorials

Tutorial website	Ease of understanding	Amount of content	Additional links to learn more
1) **https://spin.atomicobject.com/2016/07/18/xbee-tutorial/**	Takes some time to understand as it contains a lot of text and reading to go through	Images are provided to help understand the components better.	No links are provided.
2) **https://learn.sparkfun.com/tutorials/exploring-xbees-and-xctu/all**	Not easy to understand as it tries to cramp so many things in one page.	Images are provided to help understand the components better.	Links to different tutorial projects are provided.
3) **https://www.instructables.com/How-to-Use-XBee-Modules-As-Transmitter-Receiver-Ar/**	Easy to understand.	Images are provided to help understand the components better.	Link to Youtube tutorial is provided.

Verdict:

The tutorial that I would choose would be the third tutorial because it is easier to understand as compared to the other two tutorial and the Youtube tutorial video link provided will make it easier for me to understand.

[2649 words]

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