UOW MALAYSIA KDU PENANG UNIVERSITY COLLEGE
PART OF THE UNIVERSITY OF WOLLONGONG AUSTRALIA GLOBAL NETWORK

ASSIGNMENT COVER PAGE

Validated by: UNIVERSITY OF LINCOLN UNITED KINGDOM

Programme	**Course code and title**
Bachelor of Computer Science (Hons)/ Bachelor of Computer Science (Hons) in Computer and Network Technology/ Bachelor of Information Systems (Hons)/ Bachelor of Software Engineering (Hons)	CET3063/N/CET3064 Internet of Things
Student's name / student's ID	**Lecturer's name**
0204677 Lim Zhe Yuan	Dr. Khoo Hee Kooi

Date issued	**Submission deadline**	**Indicative weighting**
13th February 2023 (Week 3)	17th April 2023 (Week 12)	30%
Assignment 2 title	Feed sensor data onto a cloud service (400 words)	

This assessment assesses the following course learning outcomes

# as in course guide	**UOW Malaysia KDU Penang University College learning outcomes**
CLO1	N/A
CLO2	Evaluate and design IoT system architecture for a real world application.
CLO3	Develop a virtual IoT system for a specific application using cloud services and network sensors.
CLO4	N/A
# as in course guide	**University of Lincoln learning outcomes**
CLO1	Critically evaluate the strengths, weaknesses, and resource constraints of IoT computing systems in comparison to traditional computing models
CLO2	Design and implement a connected prototype IoT software system that utilises sensor data
CLO3	Implement industry standard IoT messaging protocols
CLO4	N/A

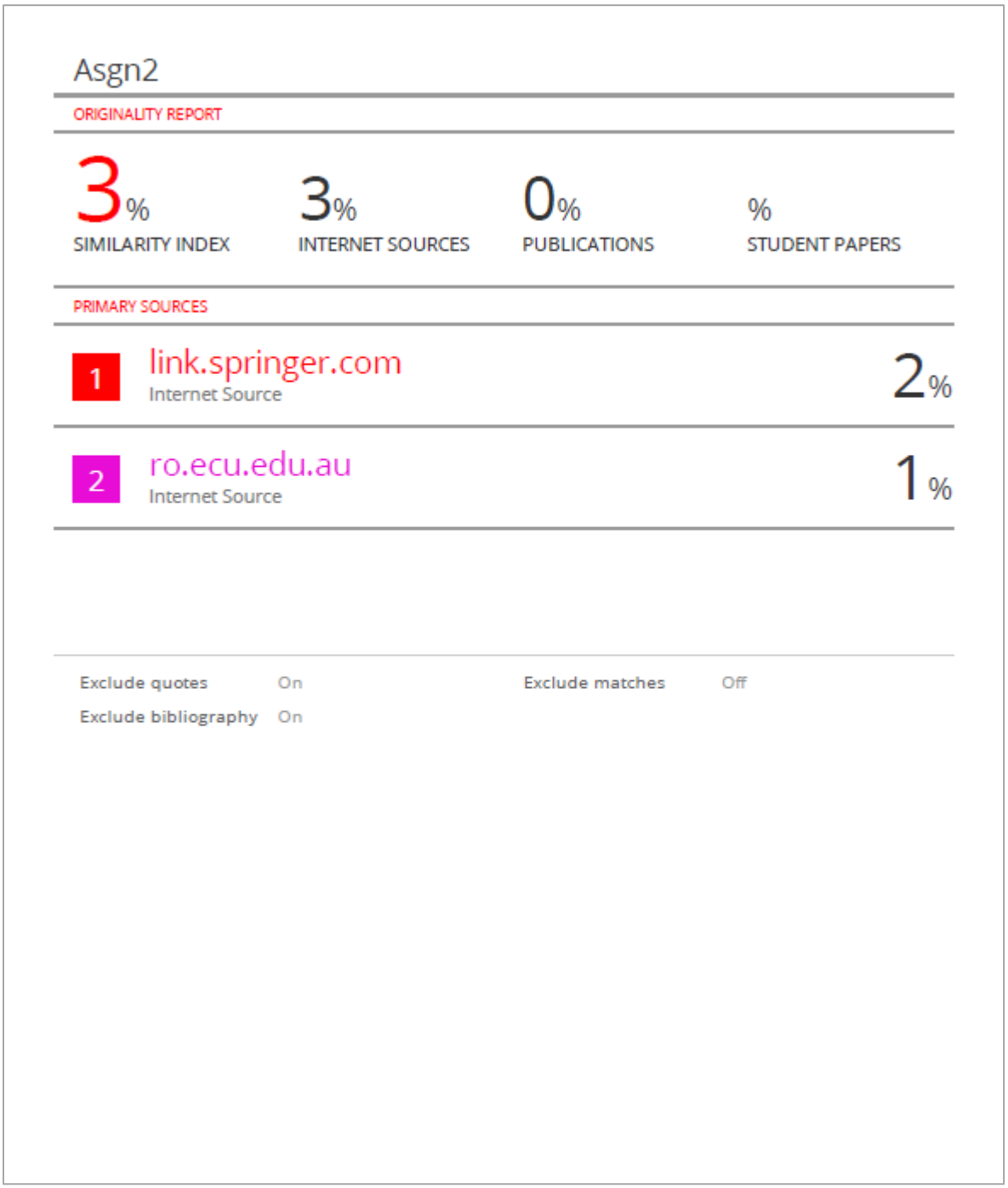
Student's declaration

I certify that the work submitted for this assignment is my own and research sources are fully acknowledged.

Student's signature: Submission date:

Zhe Yuan **17/4/2023**

TurnItIn Similarity Report



Asgn2

ORIGINALITY REPORT

3%	3%	0%	%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	link.springer.com Internet Source	2%
2	ro.ecu.edu.au Internet Source	1%

Exclude quotes	On	Exclude matches	Off
Exclude bibliography	On		

Table of Contents

Main Report

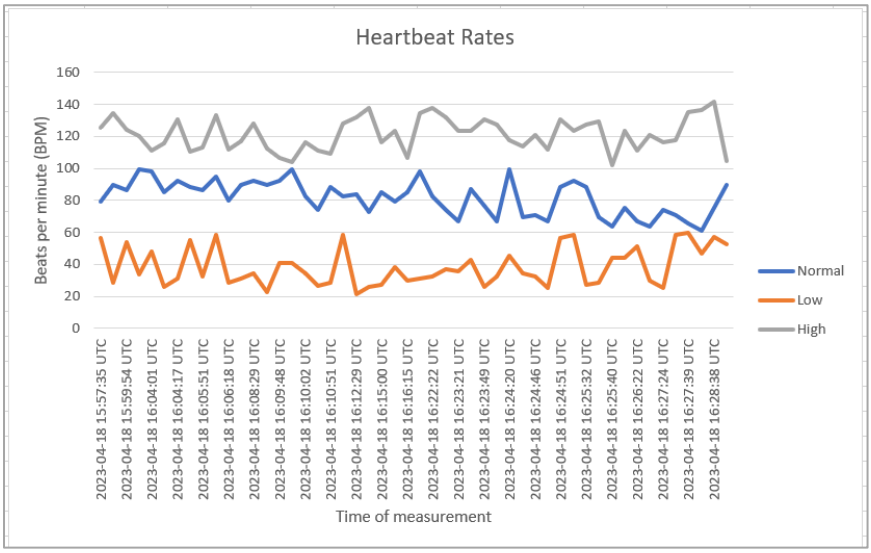
- **Obtained BPM data**

After taking large amount of heart rate readings using the developed heart rate monitoring system, 3 distinct categories are created to fit varying heart rate values, which are high, normal, and low heart rates. According to DiGiacinto and Seladi-Schulman (2022), normal heart rates usually fall between the range of 60 to 100 beats per minute. Therefore, at least 150 readings have been taken based on this knowledge to correctly categorize each heart rate value to their respective groups. Additionally, the root mean square (RMS) value for each category is computed using the following formula:

$$\textbf{Root mean square} = \sqrt{\frac{1}{n}(x_1^2 + x_2^2 + x_3^2 + \cdots + x_n^2)} \ ,$$

where n = total number of BPM data per category

The following graph shows the obtained heart rate values for each category over time, and the root mean square value for each category after applying the given formula:



Graph 1: *Heartbeat rate graph for each category over time*

Root mean square for low BPMs = 40.39
Root mean square for normal BPMs = 82.40
Root mean square for high BPMs = 121.86

- **Factors that could cause cardiovascular related diseases**

Based on ***Graph 1***, it can be seen that there are instances of heart rate values falling into the high and low category range, which surge up to 140 beats per minute and falling to approximately 20 beats per minute respectively. This abnormal and irregular heartbeat count and rhythm is commonly dubbed arrhythmia, and this phenomenon naturally occurs when blood supply from the heart is suspectedly disrupted, damaged, or compromised (Macon, 2023).

Visible symptoms of arrhythmia indicate a major risk to the patient as it can further worsen into many different cardiovascular diseases, including but not limited to valve disease, coronary artery disease, peripheral artery disease heart failure, cerebrovascular disease, and many more (Cleveland Clinic, 2022). All of these diseases are common in terms of narrowing and blocking normal blood flow in blood vessels, arteries and valves, which in turn causes the patient to bear the risk of high blood pressure. Therefore, people should beware of the symptoms of arrhythmia, which includes (Macon, 2023):

- feeling dizzy
- shortness of breath
- chest pain
- pale skin
- sweating
- fatigue

A few risks that have been associated with arrhythmia include unhealthy practice such as smoking, alcohol or drug consumption, inherited or previous health conditions, stress, and being physically inactive overall (Macon, 2023).

- **Solutions to improve system accuracy and stability**

Several measures can be taken to improve the accuracy and stability of the current system to provide more reliable heartbeat readings. Firstly, raw sensor readings can be re-calibrated if there are offset errors in sensor values. This means that developers can manually recalculate the sensor value in the system's code to fit them into context if marginal differences between the sensor values and expert facts are very large. As it is already known that normal heartbeat rates should range between 60 to 100, raw, incorrect sensor values can be subtracted by around 30 to allow values to fall within range and increase reading accuracy.

Next, system users can also ensure that no other electronical noises are occurring when the system is reading heartbeats. It has been mentioned that sensors may also encounter errors due to noise and issues with signal processing between other existing, running electronical components. Aliasing, or collision of different processing component signals forms artifacts in the data acquisition process, which in turn reduces data accuracy (Voler Systems, 2023).

Lastly, developers can also increase the number of samples for a heartbeat reading session. This allows the computation of a heartbeat average and identify the

common ranges of the obtained heartbeat values. This approach applies the Law of Large Numbers, which states that the result will grow closer to the true average following the enlargement of the sampling size (James and Rathburn, 2022). This solution is only effective if the samples do not fluctuate drastically and should be applicable for an average user that already has a steady heartbeat in most cases.

References

Cleveland Clinic (2022) *Cardiovascular Disease*. Available at https://my.clevelandclinic.org/health/diseases/21493-cardiovascular-disease [accessed 16 April 2023].

DiGiacinto, J. and Seladi-Schulman, J. (2022) *Normal vs. Dangerous Heart Rate: How to Tell the Difference*. Healthline. Available at https://www.healthline.com/health/dangerous-heart-rate [accessed 16 April 2023].

Macon, L. B. (2023) *What You Need to Know About Abnormal Heart Rhythms*. Healthline. Available at https://www.healthline.com/health/abnormal-heart-rhythms [accessed 16 April 2023].

James, M. and Rathburn, D. (2022) *Law of Large Numbers: What It Is, How It's Used, Examples*. Investopedia. Available at https://www.investopedia.com/terms/l/lawoflargenumbers.asp [accessed 16 April 2023].

Voler Systems (2023) *Device Design: Strategies to Improve Sensor Accuracy and Reliability*. Available at https://www.volersystems.com/blog/device-design-strategies-to-improve-sensor-accuracy-and-reliability [accessed 16 April 2023].

CET3063/N/CET3064 Internet of Things

MARKING RUBRIC

Assignment 2

Feed sensor data onto a cloud service (Weighted marks: 30%)

Question 1: Establish a cloud service (Score: 50%)

LEARNING OUTCOME	MARKING CRITERIA	SCALE					
		Failed (0% to 49%)	**3rd class (50% to 59%)**	**2nd lower (60% to 69%)**	**2nd upper (70% to 79%)**	**1st class (80% to 100%)**	**YOUR MARKS/COMMENTS**
CLO3: Develop a virtual IoT system for a specific application using cloud services and network sensors.	**1(a) Cloud service configuration (10%)**	No cloud service has created.	Cloud service has created, but without authentication and certain inappropriate settings have set.	Cloud service has created with an authentication feature, however certain inappropriate settings have set.	Good configuration of cloud service with proper authentication and settings have set.	Excellent configuration of cloud service with comprehensive authentication and parameters have set.	
	1(b) Code implementation (20%)	No implementation for the cloud service.	Erroneous in the implementation for the cloud service. CRUD operations could not be performed.	Good implementation for the cloud service. However, two CRUD operations could not be performed.	Good implementation for the cloud service. All required CRUD operations can be performed.	Excellent implementation for the cloud service. All required CRUD operations can be performed. Code are well written for efficiency.	
	1(c) Data structure (10%)	No implementation for the data structure.	Brief design for the data structure. It is relatively hard to interpret the sensor data.	Good implementation for the data structure, however there are some mistakes in the naming of attributes.	Good implementation for the data structure with correct naming of attributes. It is easy to interpret the sensor data.	Excellent implementation for the data structure with compact naming of attributes. It is relatively easy to interpret the sensor data.	
	1(d) Data estimation (10%)	No implementation for the data estimation.	Erroneous in the implementation for the data estimation. Inappropriate usages of formulation and data types in the program.	Good implementation for the data estimation. However, inappropriate usage of either formulation or data types in the program.	Good implementation for the data estimation. Appropriate usages of formulation and data types in the program. Accurate results are obtained.	Excellent implementation for the data estimation with comprehensive usages of formulations and data types in the program. Precise results are obtained.	
						Total (50%)	

Question 2: Evaluate sensor data (Score: 50%)							
LEARNING OUTCOME	**MARKING CRITERIA**	**SCALE**					
		Failed (0% to 49%)	**3rd class (50% to 59%)**	**2nd lower (60% to 69%)**	**2nd upper (70% to 79%)**	**1st class (80% to 100%)**	**YOUR MARKS/COMMENTS**
CLO2: Evaluate and design IoT system architecture for a real world application.	**2(a) Graph(s) representation (20%)**	No graph has generated.	Graph(s) has/have generated, but it is insufficient to represent the developed IoT system due to limited sensor datasets are collected.	Proper graph(s) has/have generated with sufficient datasets have collected. However, there are certain inappropriate uses of graphic elements.	Proper graph(s) has/have generated with sufficient datasets have collected and proper uses of graphic elements.	Outstanding graph(s) has/have generated with sufficient datasets have collected and proper uses of graphic elements, as well as resolution to highlight certain important.	
	2(b) Key points identification (10%)	No key point has identified.	Unclear points have identified to reflect the developed IoT system.	Good key points have identified to reflect the developed IoT system. However, there are certain misconceptions in the discussions.	Good key points have identified to reflect the developed IoT system with proper concepts. However, technical details need to be further clarified.	Excellent key points have identified to reflect the developed IoT system with proper concepts and technically sound.	
	2(c) Feasibility of the solutions (20%)	No solution has discussed.	Unclear solutions have suggested to improve the developed IoT system.	Good solutions have suggested to improve the developed IoT system. However, there are certain misconceptions in the discussions.	Good solutions have suggested to improve the developed IoT system with proper concepts. However, technical details need to be further clarified.	Feasible solutions have suggested to improve the developed IoT system with proper concepts and technically sound.	
	Total (50%)						
Overall score (100%)							
Weighted marks (30%)							