UOW MALAYSIA KDU PENANG UNIVERSITY COLLEGE

PART OF THE UNIVERSITY OF WOLLONGONG AUSTRALIA GLOBAL NETWORK

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ASSIGNMENT COVER PAGE

Programme	Course Code and Title
UCSEW - BACHELOR OF COMPUTER SCIENCE (HONS) / UCNT - BACHELOR OF COMPUTER SCIENCE (HONS) IN COMPUTER AND NETWORK TECHNOLOGY	CAT3053/N Distributed Computing
Student's name / student's id	**Lecturer's name**
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Date issued	Submission Deadline	Indicative Weighting
Week 7 – 13/03/2023	Week 12 – 21/04/2023	30%
Assignment [2] title	Report Writing	

This assessment assesses the following course learning outcomes

# as in Course Guide	UOWM KDU Penang University College Learning Outcome
CLO3	Evaluate distributing computing solutions in response to business-related problems. (C6, PLO7)

# as in Course Guide	University of Lincoln Learning Outcome
	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: *Zhe Yuan*

Submission Date: 21/4/2022

TurnItIn Similarity Report

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ORIGINALITY REPORT

18%	10%	18%	5%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	Djallel Eddine Boubiche, Muhammad Imran, Aneela Maqsood, Muhammad Shoaib. "Mobile Crowd Sensing – Taxonomy, Applications, Challenges, and Solutions", Computers in Human Behavior, 2018 Publication	5%
2	upcommons.upc.edu Internet Source	3%
3	docplayer.net Internet Source	3%
4	Tu N. Nguyen, Sherali Zeadally. "Mobile Crowd-sensing Applications: Data Redundancies, Challenges, and Solutions", ACM Transactions on Internet Technology, 2022 Publication	2%
5	encyclopedia.pub Internet Source	2%
6	www.researchgate.net Internet Source	1%

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Main Report

- **Part 1: Mobile Crowdsensing**

Mobile crowdsensing (MCS) is a means of collecting people's surrounding information via mobile sensing devices (Sei and Ohsuga, 2020). It is an emerging sensing and geo-crowd sourcing paradigm, based on mobile sensors, that enables acquiring local geospatial information and knowledge and giving the possibility to share this information with the broader community (Boubiche et al., 2018). These mobile sensing devices are essentially portable, such as smartphones or minicomputers which moves around using different means of transportation. MCS typically comes in 2 forms, which are participatory and opportunistic crowdsensing. Participatory crowdsensing is used if users possess control over the choice of contributing data, whereas opportunistic crowdsensing is used if data collection happens automatically with minimal intrusion and user intervention (Wiltz, 2018). It was theorised that MCS have captivated attention due to their suitability for an enormous range of new types of context-aware applications and services. The emergence of these applications is attributed by the advancements in mobile and wireless communication technologies and efficient and high capability networks, which allows better connectivity to billions of ubiquitous smartphones and vehicular system sensors (Boubiche et al., 2018).

A general MCS architecture consists of 3 layers for data sensing and storage, data processing, and application services. Firstly, the data sensing and storage layer directly involves the sensing components and their storage infrastructures. This layer also handles the heterogeneity of data sources by establishing a standard data collection paradigm and interface. Then, the data processing layer is responsible for data analysis, learning and mining to extract meaningful information. This layer can either operate locally on the mobile device or on the cloud. In other words, both layers are essential pillars that enable the continuous circulation of data and their propagation to the IoT servers (Ganti et al., 2011). Lastly, the application service layer provides the user interfaces for proper and comprehensive presentation of the processed results (Boubiche et al, 2018).

According to Ganti and their team (2011), MCS applications are classified into three categories: environmental, infrastructure, and social. Environmental MCS applications gathers mass phenomenal data and enables the measurement of natural environments, such as pollution levels in cities, water levels in creeks, and monitoring of wildlife habitats. Infrastructure MCS applications concerns about public infrastructure information, like traffic congestion, road conditions, parking availability, and outages of public works. Lastly, social MCS applications allows public sharing of individual data and allows the comparison of normal data shared by the rest of the community. For instance, personal routines. strategy, preference are some data that are commonly shared using social MCS applications. Some examples of MCS application deployments have been provided for each category by Ganti and their team (2011):

Environmental:
- **CommonSense** (air pollution monitoring)
- **CreekWatch** (creek water levels and quality monitoring)

Infrastructural:
- **CarTel** (car speed and location measurement)
- **Nericell** (road traffic monitoring)
- **ParkNet** (available parking spot detection)

Social:
- **BikeNet** (individual bike route and location measurement)
- **DietSense** (individual diet habit control)

- **Part 2: Benefits, Limitations and Challenges**

According to Nguyen and Zeadally (2022), conventional data collection methods using wireless sensor networks (WSN) suffer from disadvantages such as deployment location limitation, geographical coverage, as well as high construction and deployment costs. Unlike WSN, MCS becomes even more beneficial and convenient as the conglomerated use of mobile sensing devices, such as modern smart phones, allows MCS to boasts more resource capacity than WSN and possess characteristics such as increased sensing and computing power, memory storage, and communication range, due to the use of better hardware than mote-class sensors (Boubiche et al., 2018; Ganti et al., 2011). On top of reducing network deployment costs and easing network maintenance, these specifications also enable the crowdsensing system to scale as more contributors appear in accordance with the emergence of new business requirements (Liu, 2020).

Besides, it is also obvious that the ability of MCS to gather large amount of meaningful data enables the facilitation of crowdsourcing. Using MCS, large amounts of unstructured data can be obtained effortlessly without requiring intensive human labour and intervention. These data can then be crunched and consumed by using the processed information to train enterprise-level deep learning models (Wiltz, 2018). Businesses will be able to gain insightful statistics about data patterns using the models and derive a subject’s current conditions or customer behaviour based on data trends. Moreover, organization leaders are not the only beneficiary of the availability of big data, as it was mentioned that many science and engineering researchers could also collect these large amounts of sensed data for various experiments as well to improve business products (Talasila et al., 2020).

Although MCS is theoretically convincing, it was proven that the technology still poses several challenges to businesses in general. Firstly, modelling and predicting the energy and bandwidth usage to accomplish a particular task is harder than traditional sensor networks due to the diversity of the set of sensing devices used. It is difficult to determine the configuration of MCS so that energy and bandwidth can be maximized without trading off sampling adequacy and accuracy. (Ganti et al., 2011).

Another challenge is data privacy, security, and integrity. A controversial flaw of MCS is that sensitive individual data maybe collected without properly asking for their consent. This induces bad impression of the technology and even mental illnesses. Privacy leakage are also direct causes of malicious party attacks that aim to steal confidential user data. These attackers may also poison data collection by supplying fake sensed data, destroying data integrity and paralyzing the MCS network (Liu, 2020).

Lastly, the establishment of incentive mechanisms of MCS is also a challenge. Crowdsensing relies on the participation of the community and consumes their mobile sensing equipment, which provides the sensed data while bearing the threat of privacy leakage. Therefore, a reasonable incentive mechanism is needed to compensate for their contribution to the MCS network (Liu, 2020). An attractive compensation will be able to further motivate and retain more participants to ensure the quality of the data collection process (Ganti et al., 2011).

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Boubiche, D. E., Imran, M., Maqsood, A., & Shoaib, M. (2018) Mobile Crowd Sensing – Taxonomy, Applications, Challenges, and Solutions. *Computers in Human Behavior*. Available from https://sci-hub.se/10.1016/j.chb.2018.10.028 [accessed 4 October 2023].

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CAT3053/N Distributed Computing Marking Rubric ASSIGNMENT [2] Report Writing (Weighted marks: 30%)							
REPORT COMPONENT (100%)							
LEARNING OUTCOME	**MARKING CRITERIA**	**SCALE**					
		Fail (0-49)	**3rd Class (50-59)**	**2nd Lower Class (60-69)**	**2nd Upper Class (70-79)**	**1st Class (80-100)**	**YOUR MARKS/COMMENTS**
CLO3: Evaluate distributing computing solutions in response to business related problems. (C6, PLO7)	**1. Elaboration of Distributed Computing Solution in Business Setting (45%)**	Students demonstrate superficial understanding towards Distributed Computing Solution in Business Setting.	Students demonstrate acquisition of new content from significant learning experiences. Report entry provides evidence of gaining knowledge, making sense of new experiences, or making linkages between old and new information related to Distributed Computing Solution in Business Setting.	Students demonstrate thoughts about or challenges to beliefs, values, and attitudes of self and others. Report entry provides examples of self-projection into the experiences of other, sensitivity towards the values and beliefs of others, and/or tolerance for differences related to Distributed Computing Solution in Business Setting.	Students demonstrate the application of learning to a broader context of personal and professional life. Report entry provides evidence of student's use of readings, observations, and discussions to examine, appraise, compare, contrast, plan for new actions or response, or propose remedies to use in and outside structured learning experiences related to Distributed Computing Solution in Business Setting.	Students demonstrate examination of the learning process, showing what learning occurred, how learning occurred, and how newly acquired knowledge or learning altered existing knowledge. Report entry provides examples of evaluation or revision of real and fictitious interactions related to Distributed Computing Solution in Business Setting.	
	2. Evaluation of Distributed Computing Solution in Business Setting (45%)	No analysis or meaning making related to Evaluation of Distributed Computing Solution in Business Setting	No analysis or meaning making. Shows some thinking and reasoning but most ideas are underdevelop and unoriginal related to Evaluation of Distributed Computing Solution in Business Setting	Little or unclear analysis or meaning making. Analysis indicates thinking and reasoning applied with original thought on a few ideas related to Evaluation of Distributed Computing Solution in Business Setting	Some analysis and meaning making. Critical thinking is weaved into points. Analysis indicates original thinking and develops ideas with sufficient and firm evidence related to Evaluation of Distributed Computing Solution in Business Setting	Comprehensive analysis and meaning making. Reveals high degree of critical thinking. Analysis indicates synthesis of ideas, in-depth analysis and evidence original thought and support for the topic related to Evaluation of Distributed Computing Solution in Business Setting	
	3. References, Sources &Citation (10%)	Some sources are not accurately documented. Diagrams and illustrations are not accurate OR do not add to the reader's understanding of the topic. Missing or no citation and major flaws on the format.	All sources (information and graphics) are accurately documented, but many are not in the desired format. Some diagrams and illustrations are not accurate OR do not add to the reader's understanding of the topic. Very minimal amount of cited works, with incorrect format.	All sources (information and graphics) are documented, but an adequate amount is not in desired format. Diagrams and illustrations are neat and accurate and sometimes add to the reader's understanding of the topic. Adequate amount cited works, both text and visual, are done in the correct format. Inconsistencies evident	All sources (information and graphics) are accurately documented, but a few are not in the desired format. Diagrams and illustrations are accurate and add to the reader's understanding of the topic. All, both text and visual, are done with minimal errors on the format.	All sources (information and graphics) are accurately documented in the desired format. Diagrams and illustrations are neat, accurate and add to the reader's understanding of the topic. All cited works, both text and visual, are done in the correct format with no errors.	
						Total (100%)	