## Weighted Scoring Model for FIT3161 COMPUTER SCIENCE SCIENCE SOFTWARE PROJECT

Created by: MCS14	Date: 13th August 2023				
Criteria	**Weight**	**P1**	**P2**	**P3**	**P4**
Supervisor	30%	9	10	8	8
Interest	30%	9	8	8	7
Knowledge	20%	7	5	7	6
Resource	10%	8	6	8	7
Flexibility	10%	5	7	8	8
Weighted Project Scores	**100%**	**8.1**	**7.7**	**7.8**	**7.2**

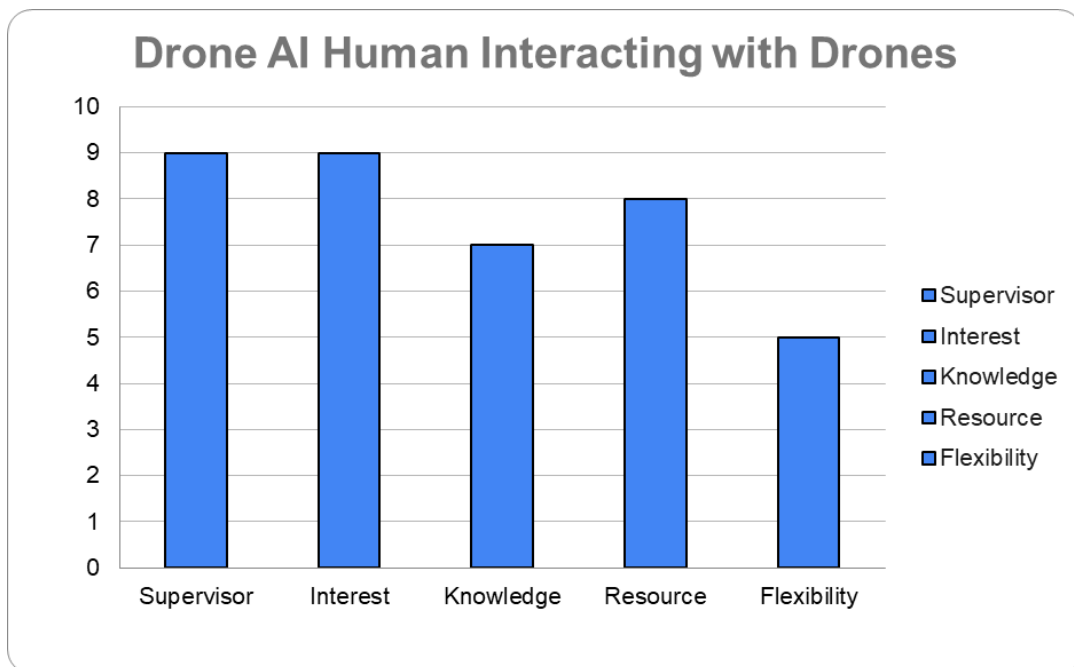|	
P1	**DroneAI Humans interacting with Drones**
P2	**Non Intrusive Load Monitoring**
P3	**Artificial Intelligence in Depression and Anxiety Undestanding**
P4	**Information-based associative analysis and deep learning for classifying time-series data**
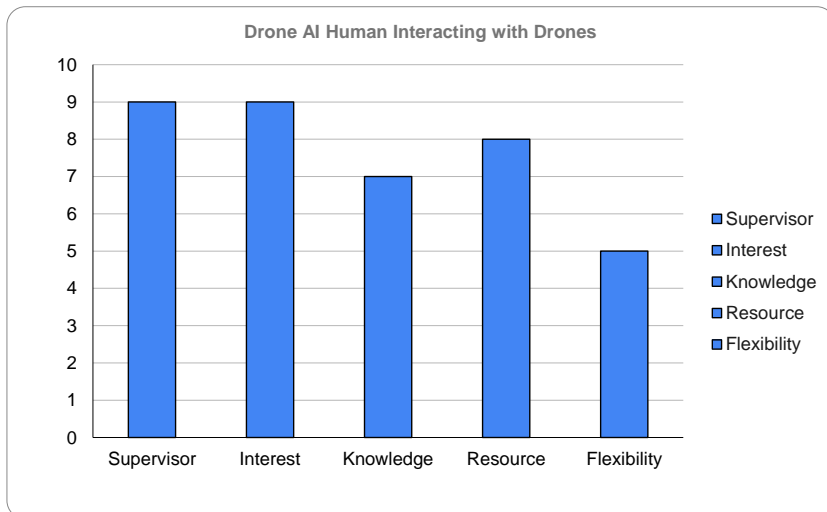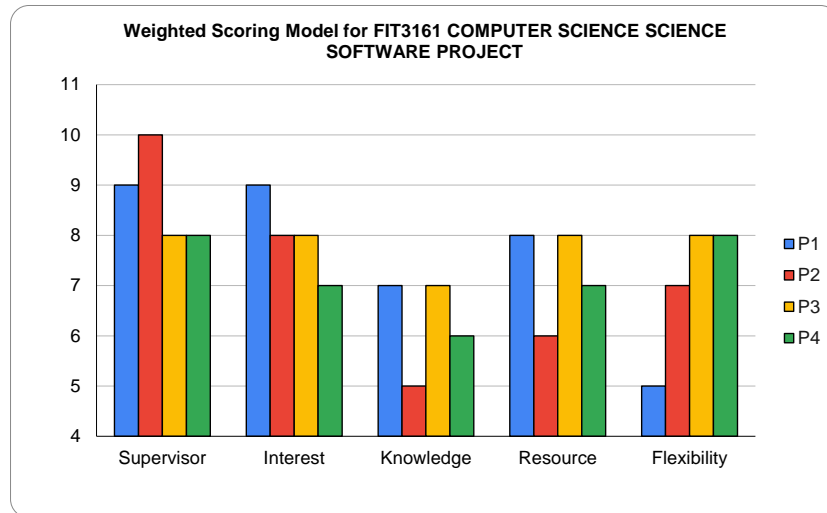
Memorandum

TO   : Ms Kamalashunee Velautham

FROM   : MCS14

DATE   : 18th August 2023

SUBJECT   : Selection of DroneAI as our Final Year Project Topic

I hope this message finds you well. We are writing to inform you that after careful consideration and discussions among team members, we have selected several project topics that align with our interests and goals.

The following are the four project topics that we were considering :
1. DroneAI : Humans interacting with Drones by Professor Raphaël Phan
2. Non-Intrusive Load Monitoring (NILM) by Dr Lim Wern Han
3. Artificial Intelligence in Depression and Anxiety Understanding by Dr Lim Chern Hong
4. Information-based associative analysis and deep learning for classifying time-series data by Dr Ong Huey Fang.

To finalise our selection of our project topic, we implemented a Weighted Scoring Model (WSM) with 5 different criterias that we had discussed and settled on.

The description and justification for those five criterias are as follows:

1. Project Supervisor - The supervisor(s) should preferably be someone who can easily be reached via different modes of communication so that information regarding the topic can be passed on and doubts within team members can be addressed quickly.
2. Interest - General interest of topic among team members. This is to ensure that none of us are working on a project topic that does not interest us which may affect the quality of our work and deliverables.
3. Knowledge - Initial knowledge of the project area and overall estimated difficulty of the project topic. Taking into account, as university students, we have other units that require our attention during the semester. If the project topic was estimated to be too difficult, it may affect the overall quality of our deliverables in this unit.
4. Resource - The amount of available online resources on the project topic. An abundance of resources may bridge the gap between having less initial knowledge on said topic and its estimated difficulty making the project topic more desirable.
5. Flexibility - The ease with which to work on the project. For instance, does the project require all 4 team members to be in one location to make any meaningful progress on the project. A higher flexibility may increase the efficiency of our work and deliverables.

We had decided to employ a 10-point scoring system to evaluate the 4 project topics based on the 5 criterias that were described above. The main reason for this being that the 10-point scoring scale allows for greater precision and enables for finer differentiation between the chosen project topics in each criteria. We believe that this level of detail was necessary considering that each of the 4 project topics had an equal opportunity to be chosen as our final year project.

We recognise that Professor Raphaël Phan has an incredible proven track record of supervising PhD students and we believe his extensive experience in that matter and knowledge on the project topic would help us realise our goals and as such warrants a very high score for the 'Supervisor' criteria. Since most of the team members are very interested in advancing drone technology and artificial intelligence, the DroneAI project topic was given a very high score for the 'Interest' criteria. However, initial knowledge on the topic among the team members is minimal except for some knowledge on facial recognition systems in security. Fortunately, available resources on drones and artificial intelligence are abundant, thus warranting an average score for the 'Knowledge' criteria and a high score for the 'Resource' criteria. Regarding the 'Flexibility' criteria, we realise that working with drones would require precision and care especially if equipped with advanced sensors, hence we have given it a below average score.

Dr Lim Wern Han's topic on NILM received overall high scores especially for the 'Supervisor' criteria, achieving a perfect score as all of us have experienced first-hand his capability and reliability to supervise as well as his availability for communication from undertaking his unit in previous semesters. However, a lack of initial knowledge and resources regarding the topic would lead to lower scores and the overall weighted score to be 0.4 less than DroneAI topic.

On the other hand, Dr Lim Chern Hong's topic on AI in depression and anxiety understanding would receive overall good scores from all of the team members, however would lose out due to the fact that the topic did not stand out when compared to the others. The project supervisor was generally favoured and interest in the topic was present but nothing substantial that would push it over the edge even though resources available on the topic are abundant and the topic being fairly flexible.

Furthermore, Dr Ong Huey Fang's topic on time series data received good scores for the 'Supervisor' and 'Flexibility criterias as the project supervisor was generally favoured but interest in the topic was low relative to the other topics and team members were lacking in the initial knowledge leading to average scores for both of those criterias

As a result, a high interest in the topic coupled with an abundance of available resources and Professor Raphaël Phan's capabilities and guidance as a project supervisor have led us to choose DroneAI: Humans interacting with Drones as our final year project topic. We look forward to the opportunity to collaborate closely on this important aspect of our academic journey.

1.0 Introduction/ Background

The combination of both artificial intelligence (AI) and drone technology are rising in different industries such as agriculture, construction, entertainment, medical, logistics and many more. Drone AI essentially uses drones with artificial intelligence algorithms that improve the efficiency and safety of tasks within the industries. Drones, also known as unmanned air vehicles(UAVs) and micro air vehicles(MAVs), are able to carry additional technologies such as sensors, cameras, microphones and many more. These features go hand in hand with artificial intelligence as it allows the capture of a large variety of datasets that enhances the AI algorithm. This opens up a large variety of applications that minimises risk of human interaction in tasks that are much more dangerous and labour intensive while increasing efficiency. Furthermore, Drones AI can be used in a form of communication between one user to another. Through Drones, we can acquire data about individuals' facial features, expression, body language, tone of voice and many more. These data will be fed into the AI algorithms to create a prediction on the individual movement, feelings, mood and many more. While utilising AI we can then develop interactions/responses that can communicate with the individual. This can be used in markets where human interaction is needed such as retail/customer services, language translations, crowd management, tourism, rescue coordinations and many more. Thus, Drone AI is a vast technology that is surging in development which will improve our standard of living in the future.

2.0 Business Objective

The purpose of Drone Artificial Intelligence Human interacting with drones is to develop an advanced algorithm that is capable of analyse human behaviours based on the data captured by the drone. These behaviours include a wide variety of aspects such as actions, facial characteristics, emotional expression, gender attributes and many more. The ability to determine these human behaviours can generate an appropriate response and feedback. This advanced algorithm capability will unlock endless possibilities of expansion across different industries. As it can be used in different applications that require human interactions such as crowd management, customer services, rescue coordination and many more. The power of human interaction combined with drone technology will enhance the future prospect of human interactions.

Besides that, the project aims to improve upon facial recognition algorithms that can verify individuals facial expressions and emotion through various drone models. This is to elevate the usability of the Artificial Intelligence algorithm across different spectra of drones available in the market. These advancements can also be used on multiple different types of

security applications that use facial authentication as their main security defences. Thus, resulting in heavy improvements in the security systems in the future.

3.0 Current Situation and Problem/Opportunity Statement

Current Situation

In recent years, the convergence of drones and artificial intelligence (AI) has led to substantial changes across various industries. Primarily, facial and human analysis has emerged as a cutting edge field with life-changing potential. In this day and age, drones with advanced sensors are able to perform complex tasks autonomously with a high degree of accuracy as a direct result of the advancement of AI driven algorithms. This convergence has enabled facial recognition and human behaviour analysis from an aerial perspective to an array of various sectors such as security and law enforcement as well as event and crowd management. With these rapid advancements, the capabilities of identifying individuals, analysing their emotions and predicting their behaviours based on visual data, when integrated into drones, will open countless new avenues and methods to enhance safety, security and operational efficiency.

Problem and Opportunity Statement

While the convergence of drones, AI and facial/human analysis offers many opportunities, several issues should be addressed beforehand to alleviate potential concerns.

The use of facial recognition technology and human behaviour analysis gives rise to privacy and ethical concerns. As such, we should maintain a balance between the use of these technologies and individual privacy which may turn out to be a thin line to navigate. In relation to the previous issue, different societies and cultures have varying reactions towards facial analysis and surveillance with some being more susceptible than others. Hence, we should respect these cultural sensitivities to ensure the success of these technologies.

Furthermore, achieving high accuracy in human and facial analysis from drones is paramount, as failure to do so could have catastrophic consequences on the affected individual. The algorithms that handle facial and human analysis should do so without any errors and undue bias which may pose a significant technical challenge without extensive and rigorous testing of said algorithms.

Due to the rapid advancements of these technologies, the laws and regulations surrounding the deployment of drones with facial and human analysis capabilities are ever changing and as such we should navigate and adhere to these regulations and at the same time making the best use of the breakthroughs in AI capabilities which may prove to be a considerable challenge.

4.0 Critical Assumption and Constraints

The ethical consideration that involves data collection carries a big responsibility that needs attention. The security used to safeguard personal data must be enhanced and updated regularly. Individuals must be fully informed that the collected data are always protected and will be exclusively used for research purposes. Artificial intelligence will be handling a huge volume of data to provide a more accurate and precise result. A substantial amount of computational power is required. Locating a third party company with the required server infrastructure is essential. However, the cost of the resources is staggering, as the expenses in acquiring a drone and server is high. Proper budgeting is important to improve the probability of creating the final result.

5.0 Analysis of Option and Recommendation

There are a few scopes that could be focused upon to address the growth of this technology:

1. **Facial Analysis**

   Artificial Intelligence capable of analysing human facial features would unlock a realm of new possibilities. Facial analysis is the capability for drones to identify human facial features for identification of a person. The artificial intelligence is able to achieve this through inferring a person's age, gender, emotions from their facial features and comparing their facial features itself. There are many purposes for such technology for instance, in the hobby drone scene, this could be used to track users in crowds and in the security field, this could be used for monitoring to identify high threats individuals in busy venues.

2. **Human Analysis**

   Despite the popularity of facial analysis, human analysis is also an interesting option for artificial intelligence. Human analysis is the ability of the artificial intelligence to infer human actions by observing human behaviours. This also allows drones to be able to unlock new abilities in various fields. For example, a hobby drone could be controlled through human actions such as pointing to move through the air. In other fields such as security, drones would be able to identify high threat actions such as theft or robberies.

Recommendation:

We recommend focusing our efforts on human analysis as it unlocks a much greater freedom of human interactions as compared to facial analysis by itself. Utilising both at the

same time would be the most optimal way as both of these would be able to enhance both its capability to be exponential. For example, being able to analyse facial features would enhance the artificial intelligence ability to analyse human actions.

6.0 Preliminary Project Requirements

The primary features required in this project are as of the following:

1. **Human identification**
   The project's artificial intelligence would be able to identify people by analysing their facial features. This could be used to identify humans in large scale crowds and busy locations such as transportation hubs.

2. **Human classification**
   The project's artificial intelligence algorithm should be able to classify a person's characteristics such as gender and emotion from facial analysis. This has potential to be utilised to identify higher threat individuals by analysing their emotions and physical characteristics.

3. **Human action analysis**
   The project's artificial intelligence can determine human actions and activities from analysing human behaviours and patterns. This can benefit many different scenarios such as using human actions to control drones by pointing, or for security reasons to monitor illegal actions.

7.0 Schedule Estimate

Week No.	Task and Milestone
Week 1-2	Technology Assessment Milestone 1: Research Plan Completed
Week 3-6	In-depth Research Milestone 2: Preliminary Feasibility Report
Week 7-9	Risk Assessment Milestone 3: Regulatory Understanding Established
Week 10-12	Synthesise Findings

	Milestone 4: Comprehensive Research Report Completed
Week 13-15	Develop Initial Prototype Milestone 5: Initial Prototype Created
Week 16-18	Refine Prototype Milestone 6: In-house Testing Completed
Week 19-21	Collect Feedback Milestone 7: External Testing Completed
Week 22-24	Prepare for Deployment/Production Milestone 8: Final Prototype and Documentation Completed

8.0 Potential Risks

The project carries several risks. Foremost, the possibility of the drone breaking during the testing phases. Considering the fragility of most drones, the breaking of the most essential part of the drone can result in it being unstable. The cost and time needed to fix the drone is substantially high. Another risk is the selection of existing artificial intelligence solutions for facial recognition on the web. Artificial intelligence depends on the integrity of training data to develop a strong algorithm that can predict an output with confidence. If the training data set has been altered, the output will be inaccurate and unreliable. To rectify the altered data, recalibrating and retraining the artificial intelligence requires a long investment of time. Moreover, the project must prioritise improving the security to protect the data collected from individuals. A breach in the security system will lead to individuals' privacy to be compromised. The main risk involves the allocation of resources in terms of time and finances towards the project and the possibility of the expected project benefits are uncertain.