M21/3/ITGSX/HP3/ENG/TZ0/XX/M

Diploma Programme
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Markscheme

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Information technology in a global society

Higher level

Paper 3

12 pages

1. (a) *FaceToFace* used the coffee shop as a proof of concept for the facial recognition application.

Outline **one** reason why the coffee shop was used as a proof of concept. **[2]**

Answers may include:

- small scale environment (the coffee shop)
- making it relatively easy for *FaceToFace* to develop their software.

- coffee shop may be on a larger scale (as it is in a University)
- the variety of customers may help better test the application.

- the FaceToFace team were familiar with the way the coffee shop operated
- meaning less information would need to be gathered/researched to create user requirements.

- less chance of legal problems with the collection and storage of data
- the customers can see the data collected and can query the staff of the coffee shop if they want to.

- it was convenient for the FaceToFace team to visit the coffee shop
- making it easier to gather information while gathering additional user information and/or developing/testing prototypes.

- cooperation of manager/staff is likely
- as the coffee shop is situated on campus, the manager and staff would be willing to assist Mike and colleagues by trialling the system and answering questions.

- coffee shop had an easily identified problem
- success of the facial recognition could easily be tested against the known problem.

- coffee shop had a loyalty card system set up already
- success of the facial recognition could be tested to replace the loyalty card.

Note: the candidate must link the answer to the coffee shop, outlining why the coffee shop is suitable.

*Award **[1]** for identifying a reason why the coffee shop was used as a proof of concept and **[1]** for a development of that reason up to **[2]** marks.*

(b) Outline **one** reason why the facial recognition application may not be able to capture an accurate image of the customer's face. **[2]**

Answers may include:

- bad lighting/wearing makeup/wearing glasses or other objects on the face
- that hinders the obtaining of a clear image or is compulsory to be worn (e.g. masks in a pandemic).

- the location of the camera
- that does not allow the camera angle to take an image of the full face, or is too far away to capture enough detail.

- A low-quality camera
- That does not capture enough detail to allow the software to identify the nodal points.

- the customer may move so the image may be blurry
- and as a consequence, the quality is not good enough quality.

*Award **[1]** for identifying the circumstances with the FR software system that could lead to reduced accuracy in correctly identifying a person and **[1]** for a development of the reason why the circumstance could hinder the correct identification up to **[2]** marks.*

2. Explain the processes *The FaceToFace* facial recognition application uses to identify a person using faceprints. **[6]**

Answers may include:
The whole process has two stages:
- the creation and storage of a faceprint
- the process for identification of an unknown person using a faceprint.

Not all the steps in stage one are required, especially the creation of the faceprint. But at the least, what a faceprint is, composed of measurements and nodes, needs to be described in the process of matching.

Stage One: The faceprint creation and storage
- image of the person's face is taken by camera
- the software identifies nodal points and other features on the face
- the number of nodal points and other features can range from less than a 100 to more than 30 000 for 3-D facial recognition
- other features of the face can also be measured such as skin tone, colour
- the nodal points are endpoints used to measure variables of the person's face, such as the length or width of the nose, the depth of the eye sockets and the shape of the cheekbones. Features other than length/width can also be measured such as colour, patterns of lines on the face, patterns of skin-tones on the face
- the measurements are stored as data and can be aggregated to create a faceprint of the person's face
- this aggregation is stored in the FaceToFace database as a record of the faceprint of the person who agrees to be part of the FR scheme.

Stage Two: Using the faceprint to identify a person
- a person is identified by matching a faceprint image taken of that person with a faceprint stored in the database
- a reasonable match would be reported as a possible identification on the output screen
- additional material that may be included but is not necessary: Since facial recognition software can be inaccurate the identification could/should be checked by a human.

Marks	Level descriptor
0	• No knowledge or understanding of ITGS issues and concepts. No use of appropriate ITGS terminology.
1–2 marks	• A limited response that indicates very little understanding of the process used by facial recognition software to produce a metric that can be used to accurately identify an unknown face. Uses little or no appropriate ITGS terminology. No reference is made to the scenario in the stimulus material. The response may only be theoretical and/or a general descriptive.
3–4 marks	• A description or superficial explanation of the process used by facial recognition software to produce a metric that can be used to accurately identify an unknown face. There is some use of appropriate ITGS terminology in the response. The description may omit some essential details of the two stages.
5–6 marks	• An explanation of the process used by facial recognition software to produce a metric that can be used to accurately identify an unknown face. Explicit and relevant references are made to the scenario in the stimulus material. There is appropriate ITGS terminology throughout the response. Candidates are likely to have addressed both stages in detail.

3. FaceToFace has told HomeThings that any potentially negative impacts on stakeholders arising from the collection and use of the data from the application must be minimized. Additionally, before FaceToFace will agree to the implementation of the facial recognition application, HomeThings will need to carry out an impact assessment.

Discuss what factors should be considered when policies are developed by *HomeThings* for the management of the data collected by the facial recognition application. **[8]**

Answers may include:
Candidates would be expected to describe a range of considerations and discuss their appropriateness, based on the potential impacts, and how they would be used in the policies to manage the collection and use of the data. This balancing of the nature of the data collected, its sensitivity (which seems on the surface to be relatively harmless) and the potential ramifications of the data being used inappropriately is likely to move the candidate into the higher markbands.

A candidate who displays lateral thinking is to be given credit. For example, some candidates may argue that *HomeThings* does not hold the data and therefore is not responsible for the management of the data but *FaceToFace* is. Another example of lateral thinking would be an argument that some considerations are not important and can be ignored.

Data collected:
The data collected does not need to be specified in detail, but better responses (competent and proficient bands) would have examples appropriate to the scenario, most likely taken from or modified from the Case Study or candidates' own research. The type, amount, frequency and sensitivity of the data collected, the storage and use (actual or potential) of the data and linking of the data are the source of the negative impacts.

Factors:
The main considerations (factors) would be those related to the various data privacy principles that most countries now use as a basis for their privacy laws.

Customer considerations:

- A customer's legal and ethical privacy rights could be breached with potential impacts:
  - ◊ customers may not know about the exact data collected
  - ◊ customers may not have the option of finding out exactly what is stored about them
  - ◊ customers may be worried about the use that will be made of the data
  - ◊ customers may be worried about the security of the data collected
  - ◊ customers who stop going to the store may be worried about the length of time the data is kept/if their data can be deleted.
- in practice the impact may be on a day to day basis:
  - ◊ customers may not want intrusive advertising sent to them, or staff approaching them by name while browsing the store – they may want to remain anonymous or want to be left alone
  - ◊ in a large store it is hard to have an opt-in mechanism, so an opt-out mechanism would be needed. This could be overlooked by many customers leading to other negative impacts

◊ linking of sales to images of customers or customer records could result in staff asking how the product is performing next time the customer visits the store. Customers may find this intrusive.

Staff considerations:

- records of staff activities which may be used by HomeThings for surveillance and work performance assessment in a negative way – breaching the right to privacy
- lack of trust of the company impacting on the work environment for staff
- being watched all the time may mean staff cannot relax and interact normally with other staff.

***HomeThings* considerations:**

- non-compliance with the letter or the spirit of relevant privacy laws, potentially leading to a privacy breach with legal consequences and/or negative publicity
- loss of trust by customers through lack of transparency in response to public concern about handling personal information
- damage to the reputation of *HomeThings* if it fails to meet expectations about how personal information will be protected
- lack of concern for customers and staff with the absence of identification of privacy risks
- unnecessary costs for remedies when privacy of staff and/or customers has been damaged.

Impacts can be real or potential which means they may be generic in nature. Better responses (competent and proficient bands) would have examples appropriate to the scenario and their own research. Unrealistic impacts not directly related to the scenario are to be ignored.

A conclusion based on a discussion of importance would be expected, with reasons to support such conclusions provided.

Marking Guidelines
Adequate (3-4 marks): candidates will most likely describe factors, with little discussion on their importance, potential impact or appropriateness

Competent (5-6 marks): candidates will describe the factors and then include some discussion on their importance, potential impact or appropriateness

Proficient (7-8 marks): candidates would be expected to include a balanced analysis of the respective importance of the factors. To reach the higher markband, links between the factors and the management of the data would be expected.

Please see generic markband on page 9.

SL and HL paper 1 part (c) and HL paper 3 question 3 markband

Marks	Level descriptor
No marks	• A response with no knowledge or understanding of the relevant ITGS issues and concepts. • A response that includes no appropriate ITGS terminology.
Basic 1–2 marks	• A response with minimal knowledge and understanding of the relevant ITGS issues and concepts. • A response that includes minimal use of appropriate ITGS terminology. • A response that has no evidence of judgments and/or conclusions. • No reference is made to the scenario in the stimulus material in the response. • The response may be no more than a list.
Adequate 3–4 marks	• A descriptive response with limited knowledge and/or understanding of the relevant ITGS issues and/or concepts. • A response that includes limited use of appropriate ITGS terminology. • A response that has evidence of conclusions and/or judgments that are no more than unsubstantiated statements. The analysis underpinning them may also be partial or unbalanced. • Implicit references are made to the scenario in the stimulus material in the response.
Competent 5–6 marks	• A response with knowledge and understanding of the relevant ITGS issues and/or concepts. • A response that uses ITGS terminology appropriately in places. • A response that includes conclusions and/or judgments that have limited support and are underpinned by a balanced analysis. • Explicit references to the scenario in the stimulus material are made at places in the response.
Proficient 7–8 marks	• A response with a detailed knowledge and understanding of the relevant ITGS issues and/or concepts. • A response that uses ITGS terminology appropriately throughout. • A response that includes conclusions and/or judgments that are well supported and underpinned by a balanced analysis. • Explicit references are made appropriately to the scenario in the stimulus material throughout the response.

4. A high school principal has approached Carol about implementing the facial recognition application in his school. The school already has security cameras in open areas, the cafeteria and the corridors. The proposals to introduce the facial recognition application has divided opinion within *FaceToFace* and the school community.

Discuss whether *FaceToFace's* facial recognition application should be introduced in this high school. **[12]**

Answers may include:

For the introduction:

- increased efficiency and effectiveness of the school in roll-marking and the running of the cafeteria. Freeing up teacher time to carry out other [less mundane] duties
- the principal may take a utilitarianist approach that although a few students or teachers may be disadvantaged, the overall benefits outweigh the concerns about monitoring or surveillance
- may lead to less students being out of lesson as the FR application will be able to instantly detect their movement in corridors and if necessary trigger an alert to a senior member of staff or assist with discipline in other ways
- if the FR application is discussed with all stakeholders and introduced with their consent it should be seen as a "friend rather than a foe"
- a positive example of negotiated ethics that satisfies all stakeholders.
- enhanced security of the school identifying intruders and can be used for monitoring and tracing participants if thefts or bullying happen
- a committee to monitor the use of FR can be set up to handle complaints and problems.

Against the introduction:

- the technology may not be 100 % reliable so there may be examples of incorrect identification of students. Teachers may still be required to spend time on investigating false positives etc
- the position of any existing cameras may lead to the FR application not functioning as well as intended
- will the FR application be cost effective?
- will teachers use the data collected about students, eg using data from the library, cafeteria, that gives the number of hours a student spends there, rather than managing them by face-to-face interaction?
- students and teachers may see this as a form of surveillance, so privacy concerns may need to be addressed. Collating the movement of students and teachers over time is problematic.
- as many of the students are under 18 parental consent may be required, how will the school deal with parents who do not want to opt in to the new facial recognition system?
- use may grow to active monitoring of the school areas and activities in classrooms by a special employer in a room with monitors
- biometric information cannot be changed – implications if it is compromised
- concerns if this information is shared eg between schools or with outside organisations like the police
- how rigorous is the ethical and impact analysis carried out by FaceToFace?
- parents and students would most likely want to be able to check the data collected and may even challenge its accuracy
- the implementation of a committee to monitor its use would be needed which could be a problem in itself to setup and operate
- racial bias – due to bias in algorithms may not work effectively in a multicultural environment.

Note to markers: the format of the ethical and impact analysis used by the school is not specified. The balanced analysis referred to in the markscheme is the student's own analysis. The student may refer to different techniques that could be used by the school, *eg* negotiations, and others in the case study or from their own research. The marks for referring to these are applied under this part of the rubric: *Explicit references are made appropriately to the information in the case study and independent research throughout the response.*

Please see generic markband on page 12.

HL paper 3 question 4 markband

Marks	Level descriptor
No marks	• A response with no knowledge or understanding of the relevant ITGS issues and concepts. • A response that includes no appropriate ITGS terminology.
Basic **1–3 marks**	• A response with minimal knowledge and understanding of the relevant ITGS issues and concepts. • A response that includes minimal use of appropriate ITGS terminology. • A response that has no evidence of judgments, conclusions or future strategies. • No reference is made to the information in the case study or independent research in the response. • The response may be no more than a list.
Adequate **4–6 marks**	• A descriptive response with limited knowledge and/or understanding of the relevant ITGS issues and/or concepts. • A response that includes limited use of appropriate ITGS terminology. • A response that has evidence of conclusions, judgments or future strategies that are no more than unsubstantiated statements. The analysis underpinning them may also be partial or unbalanced. • Implicit references are made to the information in the case study or independent research in the response.
Competent **7–9 marks**	• A response with knowledge and understanding of the relevant ITGS issues and/or concepts. • A response that uses ITGS terminology appropriately in places. • A response that includes conclusions and/or judgments that have limited support and are underpinned by a balanced analysis. • Explicit references to the information in the case study or independent research are made at places in the response.
Proficient **10–12 marks**	• A response with a detailed knowledge and understanding of the relevant ITGS issues and/or concepts. • A response that uses ITGS terminology appropriately throughout. • A response that includes conclusions, judgments or future strategies that are well supported and underpinned by a balanced analysis. • Explicit references are made appropriately to the information in the case study and independent research throughout the response.