UNIVERSITI TEKNOLOGI MALAYSIA
FACULTY OF ENGINEERING
SCHOOL OF COMPUTING
SESSION 2020/2021 SEMESTER 1

SCSJ 3553: ARTIFICIAL INTELLIGENCE

SECTION 07

Project

COVID-Multi Scanner(CMS)

LECTURER NAME : DR AIDA BINTI ALI

GROUP MEMBER :

1. **MOHD ANAS BIN ADNAN** **(B19EC0043)**
2. **YAP XIN YIN** **(A18CS0276)**
3. **NURAMYRA NATASHA BINTI ISMALLUDIN** **(B19EC0035)**
4. **NUR HASANAH BINTI SARIDDON** **(B19EC0033)**

Table of Contents

1. AI Solution

Our current situation is where the pandemic Covid-19 has taken place worldwide. Majority countries all around the world have suffered from this pandemic Covid-19. The statistics shown by the World Health Organization (WHO) where the total number of people that are infected all around the world are 53.6 million people. The United States is the country where many people have been infected with the 11 million people. Based on the statistic given by the World Health Organization (WHO) Malaysia is in 85 number of countries with 46 thousand people have been infected. Many ways Malaysia government have done to flatten the graf curve of the covid-19 such as lockdown and physical distance. The government of Malaysia also has developed an application to trace risk of people and the place that citizens have visited. This application is called mySejahtera. The citizens need to have smartphone and internet access to scan the Qr code. This will be a struggle for the person who does not have any smartphone. The government gives an option to those that do not have any smartphone to write down the information through the books that have been provided by any shop. Covid-19 is infected by the contact. In this case, it will make contact with the pen that has been used to complete the information at the shop.

Our focus is to reduce the risk of those contacts of people when come to Covid-19. Our government is having a struggle in the process to flatten the graft of Covid-19. We have identified the most effective way to trace by face recognition. By having this it also can get the current body temperature which is one of the most symptoms if the person has Covid-19. This device can detect the face of the individual and can get the information like name and phone contact. The citizens need to open their face masks to detect their face. The device also will get the current body temperature and it will display the information of the individual and the current body temperature. After that the device will show whether the person can enter the shop or cannot enter. This device will help the people that do not have any smart phones. This also can lead to more effectiveness in terms of the more people can scan and can get the information.

2. Goal of AI Solution

1. To create an AI that will build features in this device that can easily detect the users face and come out with their name and phone number.
2. This device also will detect the user temperature that can notify users about their condition, if the temperature is higher than the healthy conditions range this device will produce the warning sound.
3. Applied mask by the user also will be detected by the device after the temperature scanning to make sure they was follow the SOP
4. This device will keep in this data and notify the users incase if anything happen in that place

3. PROCESS OF EMPHASIZE IN DT

Our target users are all the citizens in Malaysia especially for the senior citizens. Since some of the citizens violate the rules such as not scanning the attendance and not wearing masks when hanging out. Hence, an epidemic happening right now has high probability to recur and become serious. Epidemics which are out of control often result in economic crisis and increasing mortality rate. Therefore, all citizens in Malaysia play an important role to save each other's life and redirect to normal.

The users said that it is inconvenient when their phone is in an insufficient power situation or no phone especially for senior citizens. They need to record the name and time by handwriting and using the sharing pen. This is unsanitary even though with hand sanitizer provided. For users who are illiterate will be a trouble if they don't have a phone, especially senior citizens.

The users have responded that they are confused because some of the information stated the users only need to finish the attendance recording step either write by hand or use Mysejahtera app. But the things happened when some of the users only scan the attendance by using Mysejahtera app and receive a violation ticket from the police.

The users have responded that the take attendance action is good but this is a time- consuming action. Before the users go into a shop, they need to line up for attendance scanning and take body temperature. This is inconvenient when someone is laden with bags or something. The users said that it is wasting time because they need to wait in a queue.

The users who as an owner have responded that something the users will forget to scan their attendance thus they need to hire an employee to ensure the users have finished the process by following the rules stated. This causes a burden to the users who are owners and they cannot afford the cost of hiring. Sometimes the users will miss scanning the attendance even though they have hired an employee.

4. Process of Defined in DT

There are a number of individuals who do not have a smartphone or senior citizens who do not know how to use the smartphone or any phone app. For the senior citizens, they say they often forget to carry their cell phones, or maybe some of them have very poor eyes so the screen can be dangerous for them. Besides that, bad eyesight can also make it difficult for them to write in books that have been prepared in public. In addition, some of them do not know how to register in the application or scan the QR code given in the public centre. Among the problems is that touch must be avoided, any contact can endanger a person, especially the senior citizen, since the infection in them is more likely to occur because of the weak immune system.

Moreover, waiting for a turn to scan a QR code makes individuals not only furious for waiting but also wasting precious time. This does not include the internet connectivity being down because their phone has issues, so other people in the back have to wait for their connection to get better or maybe they need to queue again to scan the QR code. It may be that the QR code cannot be identified by the phone camera and may have several consequences, such as running out of the phone batter, technical failures, etc.

We came up with the concept of developing mechanisms that makes it easy for them to enter public locations, including shopping centres, offices or supermarkets, and places needed to record the details of a person visiting a given area. After all the issues that happen to users as mentioned, this concept comes after a few observations have been made. With the same concept as MySejahtera, where automated registration of visitors through QR code, and the data store in their history then only the Ministry of Health (MOH) can view the data collected and it would be used only for the purpose of handling and reducing the COVID-19 epidemic.

We wanted to build features and functions called “face detection” through the help of artificial intelligence technologies, where they will scan their faces and still hold records in public centres. This would make it easy to monitor who is visiting and call them to do a swab test if the COVID-19 case can be traced somewhere. They may lie if they store the data on their own, and may not perform a swab test and these symptoms can spread even more.

5. KNOWLEDGE REPRESENTATION

a. Problem

- **Current Situation:**

Every citizen in Malaysia has responsibility to obey the lockdown rules when leave their home. Every citizen needs to wear mask for all the time to ensure the safety of them. No everyone will follow the rules and wearing qualified mask. Before the users go into a shop, they need to line up for attendance scanning and take body temperature by themselves. After scan the QR code for each shop, the attendance will record in check-in history.

However, the rules had caused some inconvenience to the citizen. They still able to enter the shop when there is not staff around there to check and ensure the temperature is lower than 37.5 C. Sometimes the Mysejahtera app will display error page and it is wasting time. This is inconvenient when someone is laden with bags or something. Furthermore, that it is wasting time because they need to wait in a queue and increase the risk of transmission for covid-19. Besides, it is inconvenient when their phone is in an insufficient power situation or no phone especially for senior citizens. The owners and customers need pay for the unnecessary expense if they missed follow one of the rules.

- **Applying COVID-Multi Scanner (CMS)**

Since some of the citizens violate the rules such as not scanning the attendance and not wearing masks when hanging out thus causing an epidemic happening right now has high probability to recur and become serious.

Our proposed solution is using the automatic face detection integrated with a temperature scanner instead of scanning attendance by using a phone. The users can line up to scan the face, temperature and mask by using COVIDMulti Scanner(CMS). It will reduce the take taken and reduce the exposure of risk.

The users can scan their attendance with or without face mask scanning. After scanning the face, their attendance will be recorded. So the users can scan their attendance without using the phone. Besides, it can ensure all people scan the attendance before going into a place or shop. The COVIDMulti Scanner(CMS)

included the mask detection which detects whether the user has a mask or not. Besides, the temperature detection is to scan the temperature of the user. To make an alert or signal for the user who does not follow the rules or unsatisfied body condition, the proposed COVIDMulti Scanner(CMS) have included a sound indicator.

When the user is not wearing their mask or temperature not below 37.5 C, the sound indicator will go on automatically. Hence, the users cannot go into a place or shop. If the condition is satisfied, the sound indicator is still in the off state.

With the proposed COVIDMulti Scanner(CMS), the citizen can obey the lockdown rules easily and it can avoid unnecessary expense in this emergency period thus reducing the risk of transmission of covid-19.

b. Knowledge Representation (KR)

T <= 37.5	Face_detect,F	Mask_detect,M	Sound_indicator,S
T	T	T	F
		F	T
	F	T	T
		F	T
F	T	T	T
		F	T
	F	T	T
		F	T

KR1:

IF (T <=37.5) = **TRUE AND** F = **TRUE AND** M = **TRUE THEN** S = **FALSE**

KR2:

IF (T <= 37.5) = **TRUE AND** F = **TRUE AND** M = **FALSE THEN** S = **TRUE**

KR3:

IF (T <=37.5) = **TRUE AND** F = **FALSE AND** M = **TRUE THEN** S = **TRUE**

KR4:

IF (T <=37.5) = **TRUE AND** F = **FALSE AND** M = **FALSE THEN** S = **TRUE**

KR5:

IF (T <=37.5) = **FALSE AND** F = **TRUE AND** M = **TRUE THEN** S = **TRUE**

KR6:

IF (T <=37.5) = **FALSE AND** F = **TRUE AND** M = **FALSE THEN** S = **TRUE**

KR7:

IF (T <=37.5) = **FALSE AND** F = **FALSE AND** M = **TRUE THEN** S = **TRUE**

KR8:

IF (T <=37.5) = **FALSE AND** F = **FALSE AND** M = **FALSE THEN** S = **TRUE**

c. Explanation of Knowledge Representation

KR1:

IF (T<=37.5) = TRUE AND F = TRUE AND M = TRUE THEN S = FALSE

- When Temperature below 37.5 or equal to 37.5 , face and mask were detected , the sound indicator does not produce the sound.

KR2:

IF (T <= 37.5) = TRUE AND F = TRUE AND M = FALSE THEN S = TRUE

- When Temperature below 37.5 or equal to 37.5 , face is detected and mask is not detected , the sound indicator produces the sound.

KR3:

IF (T <=37.5) = TRUE AND F = FALSE AND M = TRUE THEN S = TRUE

-When Temperature below 37.5 or equal to 37.5 , face not detected and mask was detected , the sound indicator produces the sound.

KR4:

IF (T <=37.5) = TRUE AND F = FALSE AND M = FALSE THEN S = TRUE

- When Temperature below 37.5 or equal to 37.5 , face and mask were not detected, the sound indicator produced the sound.

KR5:

IF (T <=37.5) = FALSE AND F = TRUE AND M = TRUE THEN S = TRUE

-When Temperature above 37.5 or equal to 37.5 , face and mask were detected , the sound indicator produced the sound.

KR6:

IF (T <=37.5) = FALSE AND F = TRUE AND M = FALSE THEN S = TRUE

-When Temperature above 37.5 or equal to 37.5 , face was detected and mask not detected , the sound indicator produced the sound.

KR7:

IF (T <=37.5) = FALSE AND F = FALSE AND M = TRUE THEN S = TRUE

-When Temperature above 37.5 or equal to 37.5 , face not detected and mask were detected , the sound indicator produces the sound.

KR8:

IF (T <=37.5) = FALSE AND F = FALSE AND M = FALSE THEN S = TRUE

- When Temperature above 37.5 or equal to 37.5 , face and mask were not detected , the sound indicator produced the sound.

d. First-Order Logic (FOL)

KR1:

∀ T ∀ F ∀ M ((temp_sensor(T) <=37.5) ∧ (face_detect(F)) ∧ (mask_detect(M)) -> ∃ S(sound_indicator(S) ∧ ¬(ON(S))

KR2:

∀ T ∀ F ∃ M ((temp_sensor(T) <= 37.5) ∧ (face_detect(F)) ∧ ¬(mask_detect(M)) -> ∃ S(sound_indicator(S) ∧ (ON(S))

KR3:

∀ T ∃ F ∀ M ((temp_sensor(T) <= 37.5) ∧ ¬(face_detect(F)) ∧ (mask_detect(M)) -> ∃ S(sound_indicator(S) ∧ (ON(S))

KR4:

∀ T ∃ F ∃ M ((temp_sensor(T) <= 37.5) ∧ ¬(face_detect(F)) ∧ ¬(mask_detect(M)) -> ∃ S(sound_indicator(S) ∧ (ON(S))

KR5:

∃ T ∀ F ∀ M (¬(temp_sensor(T) <= 37.5) ∧ (face_detect(F)) ∧ (mask_detect(M)) -> ∃ S(sound_indicator(S) ∧ (ON(S))

KR6:

∃ T ∀ F ∃ M (¬(temp_sensor(T) <= 37.5) ∧ (face_detect(F)) ∧ ¬(mask_detect(M)) ->

∃ S(sound_indicator(S) ∧ (ON(S))

KR7:

∃ T ∃ F ∀ M (¬(temp_sensor(T) <= 37.5) ∧ ¬(face_detect(F)) ∧ (mask_detect(M)) ->

∃ S(sound_indicator(S) ∧ (ON(S))

KR8:

∃ T ∃ F ∃ M (¬(temp_sensor(T) <=37.5) ∧ ¬(face_detect(F)) ∧ ¬(mask_detect(M))

-> ∃ S(sound_indicator(S) ∧ (ON(S))

e. Explanation of KR to Achieve the Goals

1. The first goal is to create an AI that able to record places visit by the people to replace Mysejahtera application that use smartphone. By manipulating Face, F, that will detect the people by their face which F = True and F = False. By this the devices can identify the person identification to be recorded into the government system to track the close contact of Covid-19.

2. Help to identify the people whether wear facial mask or not wear facial mask. People need to wear facial mask when they are in outside. By manipulating Facial_Mask, M, that will detect the facial mask if people use to wear facial mask which M = True and M = False. By this the devices can detect if the person wear facial mask or not wear facial mask.

3. Usually, when there is a person with higher body temperature which is more than 37.5 Celsius is one of the symptom of Covid-19. The body temperature of a person have been taken by the devices. It can be represent by T <= 37.5 for normal body temperature and T >37.5 for higher body temperature. If the body temperature, T, lower that 37.5 Celsius, the face, F, can be detect and they wear a facial mask, M.

6. STATE SPACE SEARCH

a. Details of State and Action

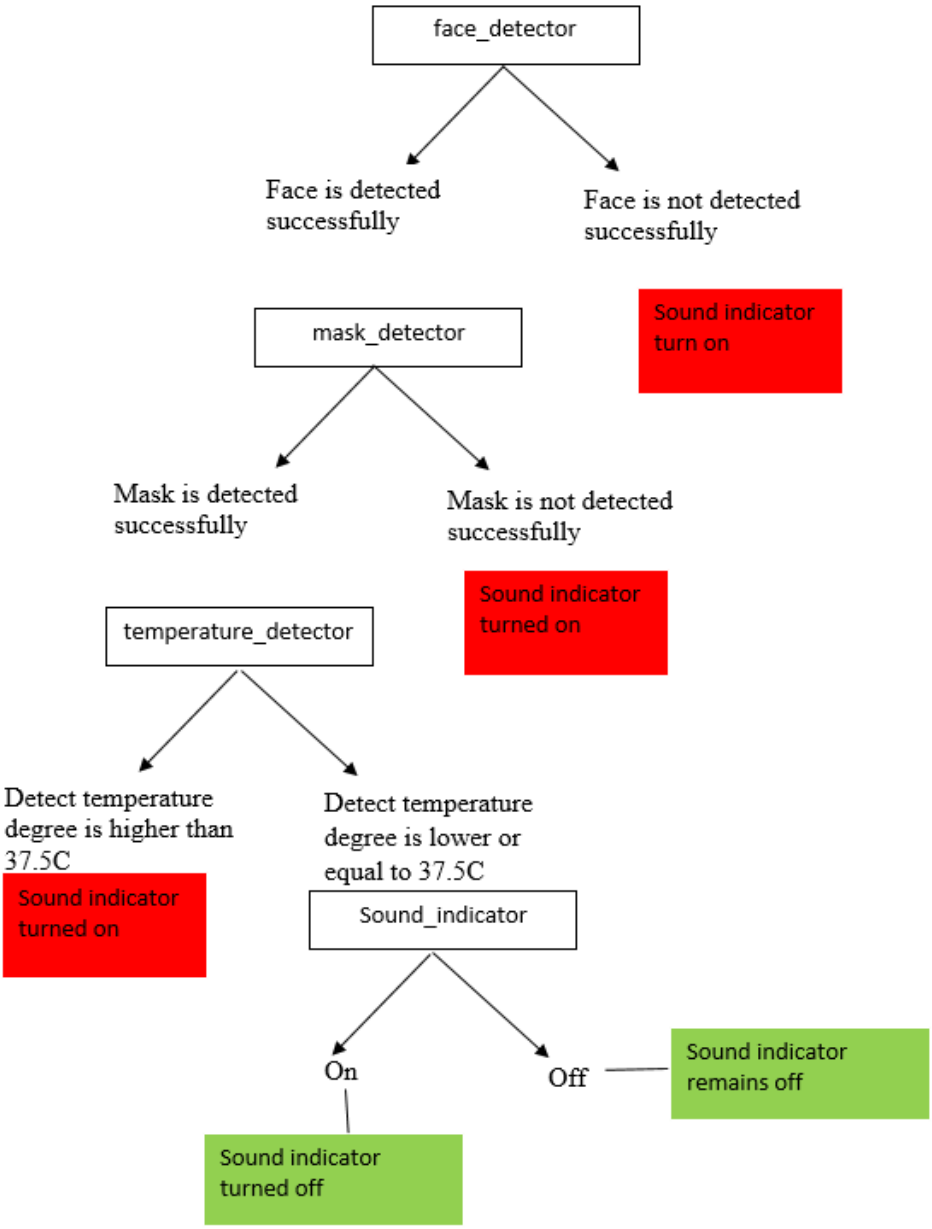
1st State : The face detector will detect whether there is information on the face or not. If the information found, the sound indicator remains off.

2nd State:After checking the face information, the mask detector will detect whether there is a mask wearing on the face or not. If the mask is detected, the sound indicator remains off.

3rd State : After checking if the mask is wearing, the temperature detector will detect whether the temperature of people is lower or equal to 37.5C or not. If lower or equal to 37.5C, the sound indicator remains off.

4th State : After checking if the temperature of people is higher than 37.5C, the sound indicator will change. If the indicator is off, then it will turn to on. If the indicator is on, it will remain on.

- **Overview Action Graph**



b. Hypergraph

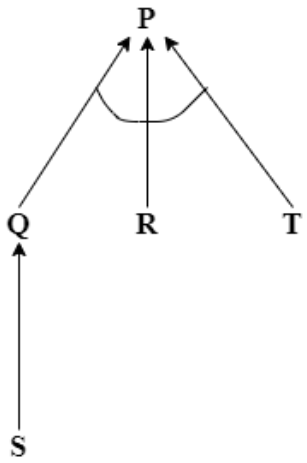
P = CMS sound indicator turn off.

Q = Mask detector detects the mask.

R = Face detector detects the face.

T = Temperature detector detects temperature with temperature <= 37.5℃.

S = Current CMS sound indicator turn off.



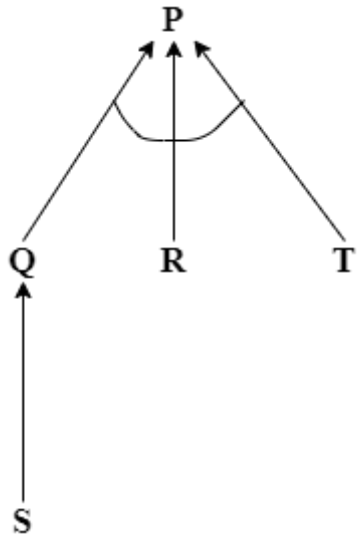
P = CMS sound indicator turn off.

Q = Mask detector detects the mask.

R = Face detector detects the face.

T = Temperature detector detects temperature with temperature <= 37.5℃.

S = Current CMS sound indicator turn on.



c. Problem Formulation

Initial State : The system needs to scan the face to get all the detailed information and see whether it is wearing a face mask or not. After that, scan the temperature below 37.5 °C to make sure the sound detection goes off.

Action : To detect face, mask, scan temperature.

Goal : Sound detector off.

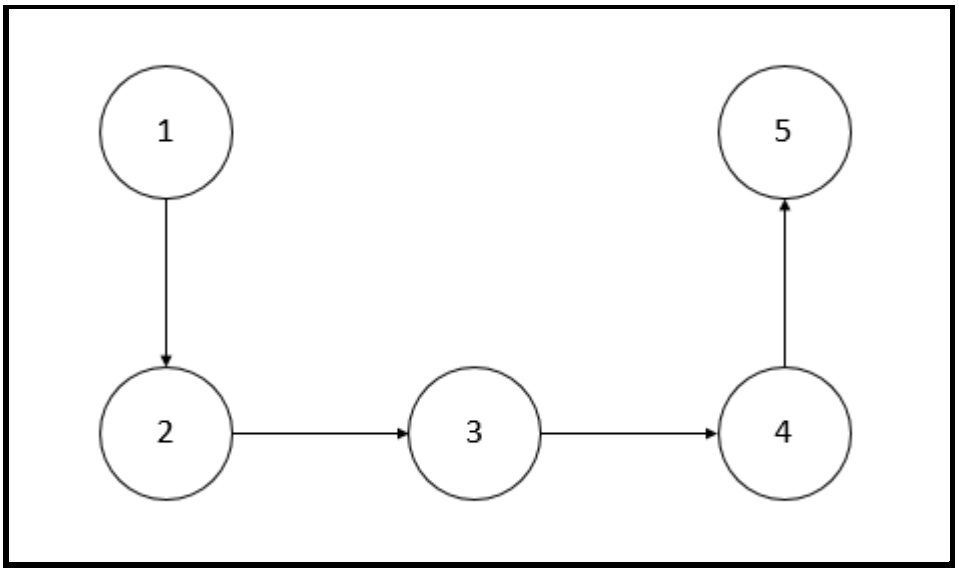
Path Costs : One unit per action

6.3.1 Table of Problem Formulation

	Face Detector	Mask Detector	Scan Temperature	Sound
1.	 Undetected	 Undetected	 Above 37.5	
2.	 Undetected	 detected	 Below 37.5	
3.	 Detected	 Undetected	 Below 37.5	

4.	 Detected	 Detected	 Above 37.5	
5.	 Detected	 Detected	 Below 37.5	

d. Sequence of Action Leading From Initial State to Goal State



e. Explanation of Formulate Problem To Support The Proposed KR

1. Show that if the face detector and mask detector were not detected and the temperature above 37.5 the sound indicator produced a sound. As shown in KR8 where the sound indicator produced a sound. The sound indicator will remain on if the temperature below or equal to 37.5 when the face and mask is not detected as shown on KR4.
2. The face detector was not detected, the mask detector was detected and the temperature above below 37.5 . The sound indicator produced a sound as shown in KR3. Same as KR7 when the face was not detected, the condition of the mask detector and temperature detector is not important.
3. When the face indicator was detected but the mask indicator was not detected and the temperature below 37.5 the sound indicator produced a sound as shown in KR2. This shows the mask must be detected before the temperature detector starts to detect the temperature as shown in KR6.
4. If the face indicator and mask indicator were detected but the temperature above 37.5 , the sound indicator also produced a sound as shown in KR5.
5. The face detector and the mask detector were detected and the temperature below 37.5 . The sound indicator did not produce any sound as shown in KR1.

7. PEAS Model

a. Formulate The Solution By Using PEAS Model

	Before Applying Covid Multi-Scanner	**After** Applying Covid Multi-Scanner
P: Performance Measure	To enter any premises • Need to scan using mySejahtera • There are number of people who do not scan so we will not be able to get data of people who has ever entered the premises • They will have to write using the pen provided • Scan the temperature manually • Some of them not wearing masks can enter the premises	To enter any premises • Scan their faces for their identity and information • Able to record their information on the day,date and time they enter the premises • Scan their masks to make sure they come in wearing face masks • Scan their temperature
E: Environment	• People, Guard • MySejahtera QR Code • Thermal scanner • Hand sanitizer will be provided	• People or customers • Devices that can scan • Hand sanitizer will be provided
A:Actuators/Effectors	• Phone to scan the MySejahtera QR Code • Scanning temperature	• Scan their identity and get their information through devices • Scan if they are wearing face masks or not • Scan their temperature

S: Sensors	• They have to scan QR Code using their phone • Use thermal scanner to check the temperature of each person	• Sound detector will alarmed if they do not wear face masks • Temperature above 37.5 will make the sound detector on

b. Define PEAS Model

AGENT : COVID-MULTI SCANNER(CMS)

Performance measure: Detect face, face mask and temperature.

- A face detector will detect the face of a person and the information of the person will be recorded for the use of the government.
- It will give the information of the person to be traced when the person is infected by covid.
- A face mask detector will detect the person wearing the face mask properly. It will reduce the chances of the person to get infected.
- A temperature detector will detect the body temperature of the person. It will be noticed if the person has covid symptoms.

Environment: Involved people.

- The environment involved is people.
- Thermal scanners are used to scan human temperatures.
- The people that want to enter the place such as a shop, restaurant and shopping mall need to be recorded so that it will be easy to trace the person or people.

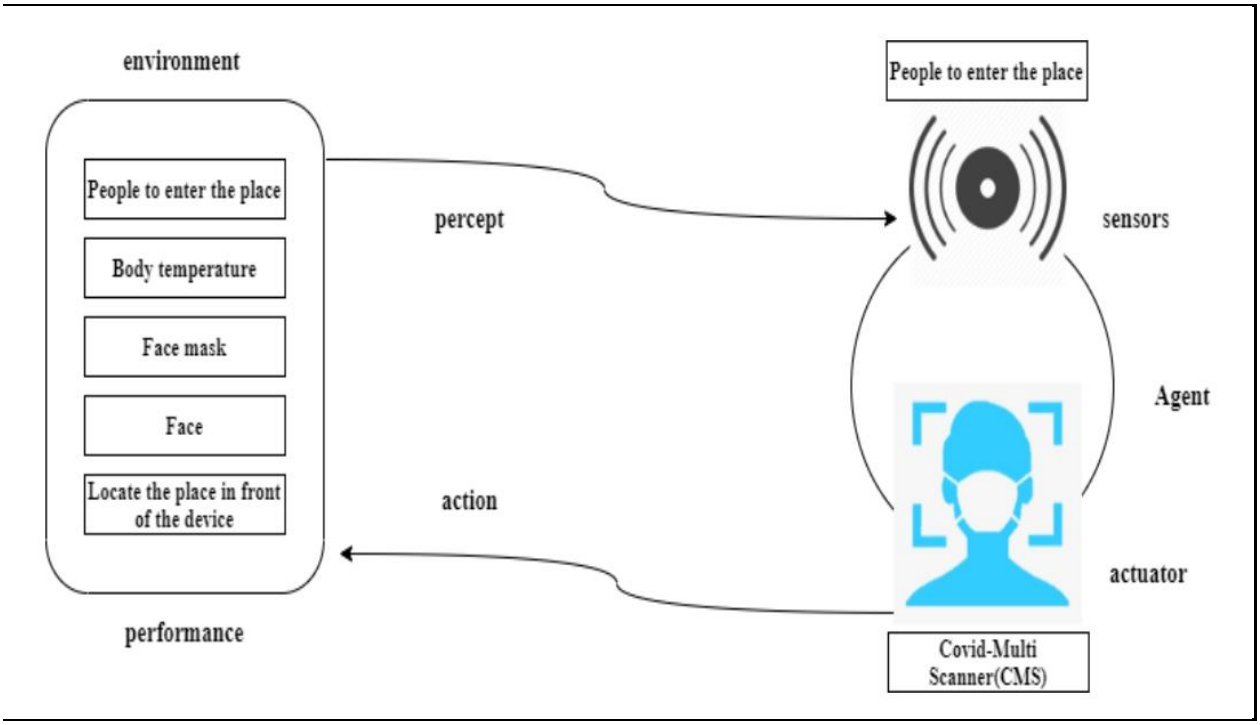
Effectors: Sound indicator.

- Sound indicator will produce a sound when one of the requirements is not completed.

Sensors: Detect temperature, face, face mask detector.

- Temperature detectors that will detect the body temperature of the people.
- Face detectors that will detect the face of the person and get the information of the person.
- Face mask detectors that will detect the person that wears the mask in the proper way or not wear the face mask.

- **PEAS Model Diagram**



- **Property Representation in Proof of Concept (POC)**

How will every element be present in POC?

I. Performance

A. The goal is to let the uninfected people enter the mall by getting their information through scanning their face. Face masks and temperature are the conditions needed to allow them to enter the mall.

II. Environment

A. Everyone will stand within 1 meter. Everyone will have their face scanned for information. Then, the face mask will be scanned to make sure they are wearing a mask. Next, the temperature will be scanned and their temperature recorded. After that, they can enter the mall to keep all places safe without anyone infected with covid-19 from spreading to others.

III. Actuator

A.The actuator will begin to perform their actions, the device will be allocated at the main entrance of the mall. First, the need to get information from the faces of people who have been scanned by devices. Afterwards, the devices will scan if they wear face masks before entering the mall to make sure they cover their mouths and noses. Then, according to the set of conditions, they will only allow people with a temperature below

37.5 to enter the mall, if the temperature of the person below that voice from the device will make a noise.

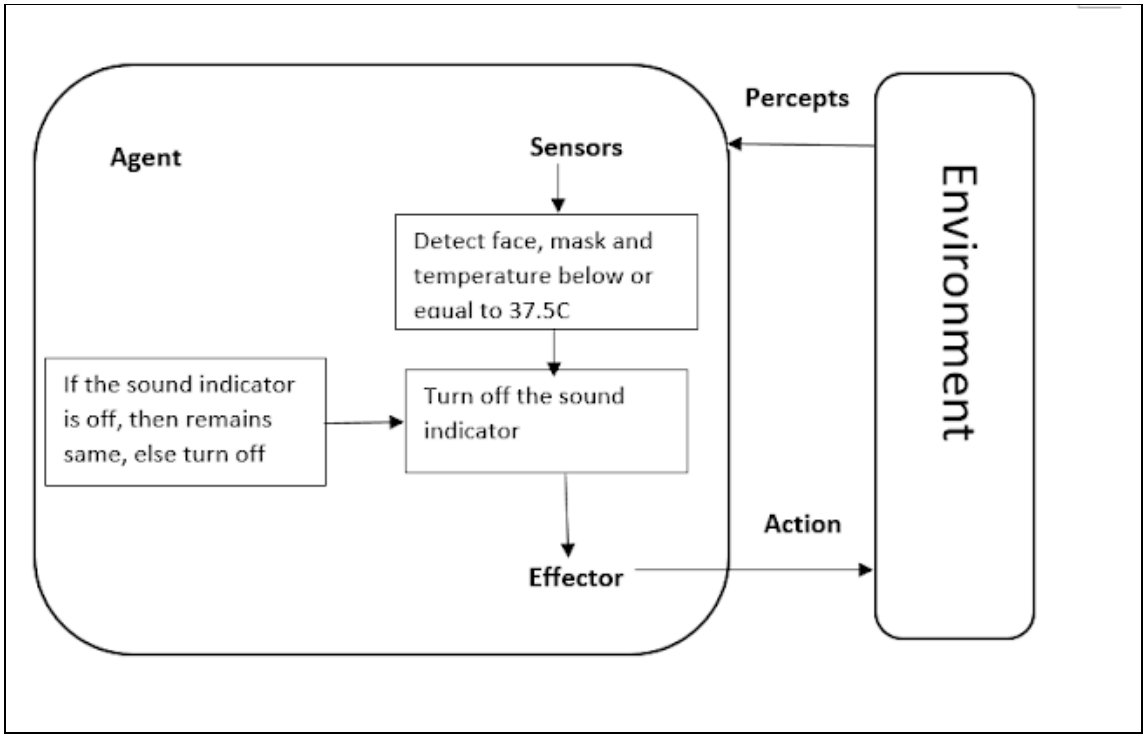
IV. Sensors

A.The sensor will detect the action performed by the actuator, for example the actuator will move and scan the person's face mask and temperature. if the predetermined conditions do not meet all of them, the sensor will issue an alarm sound which means that the person is not allowed to enter the mall.

c. Explanation of The Behavior of The Agent to Achieve The Goal

How the agent in Artificial Intelligence behaves and achieve the goal in the proposed system

The agent of COVID-Multi Scanner is a **simple reflex agent**. These agents only succeed in the fully observable environment as the face detector, mask detector and temperature detector must be taken to fulfil the condition for entering a place. It maps the current percept to action and does not consider any part of percepts history during their decision and action process. The system will loop again with different people. The system works on the Condition-action rule which works when that is a people in front of the scanner. Every percept contains the state of incoming people which is face detected, mask detected and temperature below 37.5C or either one of the conditions is not fulfilled and it decides whether to turn on the sound indicator or remain off.



8. Problem formulation

COVID-Multi Scanner(CMS) has an initial state and changes to many other states based on the temperature detector, face detector and mask detector.

When the face detector does not detect the information of the user, it will turn on the sound indicator.

When the face detector has detected the information of the user successfully, it will activate the mask detector to check whether the user is wearing the mask or not. If there is no mask detected on the face, the sound indicator will turn on.

If the mask is detected by the mask detector, it will activate the temperature detector to detect the temperature of the user. If the temperature of the user is higher than 37.0 C, the sound indicator will turn on. If the temperature is below 37.0C, it means the user is passing the 3 conditions which are the face information was recorded, mask was detected and temperature was in the low risk of infection. It will not activate the sound indicator means that the user can go into the shop or a place.

9. Design concept

Interface 1:Face Detector

Interface 2:Mask Detector

Interface 3:Temperature Detector

Users wish to have a scanner which combines the features of scanning the temperature and face information simultaneously, so AI solutions scan the face information before detecting the temperature of the user.

Besides, the user wishes to reduce the inconvenience of using a mobile device for example, insufficient power situation or no phone especially for senior citizens. Moreover, the user wishes to reduce the infection rate because for the existing process, the user needs to record the attendance by using an unsanitary sharing pen. In order to solve these problems, AI solutions can scan the face of the user and record the attendance of the user at the same time.

Furthermore, the user wishes to record the attendance efficiently to reduce the time consuming. AI solutions have combined the feature based on the requirement of the user, so that the user no need to scan the qr code for the attendance and then scan the temperature. The user can directly scan and if they do not fulfil the condition, they cannot go into a shop or a place.

Interface 4:When the user is low risk

Interface 5:The user is high risk

AI solutions which detect all the information by using face detector, mask detector and temperature detector can fulfil the wish of the user to ensure all the people have scanned their attendance at the same time to make sure there is safe body

temperature before entering a place. The sound indicator will turn on when either one of the conditions is no pass. It was a warning to the user to avoid the user going into a new place in an unsafe condition.

Users wish to reduce the infection rate and make sure all the people are wearing the mask to protect everyone safety. AI solutions have to detect the mask before scanning the temperature of the user. For this COVID-Multi Scanner(CMS), in order to reduce the rate of COVID, the user no need to open their mask for the machine to detect the face information. AI solutions can detect the face information by detecting the difference between the eye, brow of the user.

10. POC Video Link

This is the youtube link for POC video :
https://www.youtube.com/watch?v=rqaETUl4FTI