

# FINAL YEAR PROJECT 2 (2021/2022)

## MUSHROOM HOUSE MONITORING SYSTEM AND ENVIRONMENT CONTROL SYSTEM USING IOT



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# PRESENTER DETAILS



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# 1

## INTRODUCTION

SUMMARY OF THE PROJECT



## INTRODUCTION OF THE PROJECT

### GREY OYSTER MUSHROOM

- Commonly known as Oyster fungus which most edible mushrooms.
- Has cap shapes like a shell with 5 – 20 cm of diameter with colour of the mushroom can be white, yellow, pink, cream, brownish and dark grey.
- 90.8% total cultivated mushroom in Malaysia according to Ministry of Agriculture Malaysia.
- Temperature, humidity, carbon dioxide is a crucial parameters.



# 2

## PROBLEM STATEMENT, OBJECTIVE & SCOPE

MAIN PURPOSE OF THE PROJECT &  
LIMITATION OF THE PROJECT



## PROBLEM STATEMENT

### PROBLEM STATEMENT



- Grower does not alert with the changes of the environment parameters such as carbon dioxide, temperature, and humidity in the mushroom house.
- The growth of the mushroom is not efficient as environment changes can only be measure through sensory system
- Uncontrol environment parameters which affect the output of the grey oyster mushroom



## OBJECTIVES

### 1. Acquire several important parameters in the mushroom house

- Develop a system that measure the temperature, humidity and concentration of carbon dioxide in the mushroom house

### 2. Implementing IoT system in the monitoring & control system

- Develop a micro-controller-based that can monitor and control the system using Internet of Things (IoT)

### 3. Display data through web-based platform

- Develop a system that can display real-time data to a web-based system



## PROJECT SCOPE

### Limitation of the project

- ❑ Monitoring system will concentrate on grey oyster mushroom only in farmhouse located in Institute of Sustainable Agrotechnology (INSAT), Perlis.
- ❑ The system will monitor a single storage closed environment in the mushroom farm.
- ❑ System will acquire data from sensor and push to the cloud for monitoring purpose.



# 3

## LITERATURE REVIEW

BACKGROUND RESEARCH ABOUT THE  
PROJECT



## GREY OYSTER MUSHROOM

### WHAT IS GREY OYSTER MUSHROOM



- It is a wood decomposer which usually grow on the dead organic matter [1].
- The shapes consists of a cap which shapes like a shell. (Diameter: 5 – 20cm).
- It is sensitive with the several environment parameters such as Carbon dioxide level, temperature and surrounding humidity.
- Advantage of mushroom is it can preventing the formation of the growth of tumors[2].



## METHOD OF CULTIVATION

### SUMMARY OF CULTIVATION METHOD

Method	Cylindrical Baglog Method	Wooden Tray Cultivation
Size of containers	Uses plastic bags with size of 15cm x 30cm	Uses any type of shape of wood tray with size of 100cm x 50cm
Time for spawn run	Around 30 -35 days	Around 30 days
Required temperature	<ul style="list-style-type: none"><li>- During spawn run, temperature need to retained at 25°C</li><li>- During fructification, temperature need to maintain at 17 - 20°C</li></ul>	<ul style="list-style-type: none"><li>- The temperature can be retained at 25°C for both situation either spawn run or fructification</li></ul>
Production yield	Higher	Lower



## EXTRINSIC FACTOR AFFECTING THE GROWTH

### FACTOR THAT NOT CAUSED BY NATURAL PHENOMENA

Extrinsic factor	Optimum value	Reference
Temperature value	<ul style="list-style-type: none"><li>• During growth of mycelia: 25°C</li><li>• During fruit development: 25°C – 35°C</li></ul>	<input type="checkbox"/> Choi, K. W. (2004) [3]
Humidity	<ul style="list-style-type: none"><li>• During spawn running: 60% – 80%</li><li>• During growth of mycelia: 80% – 85%</li><li>• During fruit development: 80% - 95%</li></ul>	<input type="checkbox"/> Bellettini, M. B., Fiorda, F. A., Maieves, H. A., <i>et. al.</i> (2019) [4]
Carbon dioxide concentration	<ul style="list-style-type: none"><li>• During spawn-run: 20,000ppm</li><li>• During fruit development: 600ppm</li><li>• During cropping: Below 600ppm</li></ul>	<input type="checkbox"/> Oei, P. (1996) [5]



## RESEARCH GAPS

### RESEARCH GAPS ON PREVIOUS RESEARCH

- Does not have any manual control system to override the automatic control.
- System developed does not consider the area that does not have any internet coverage.



# LITERATURE REVIEW SUMMARY

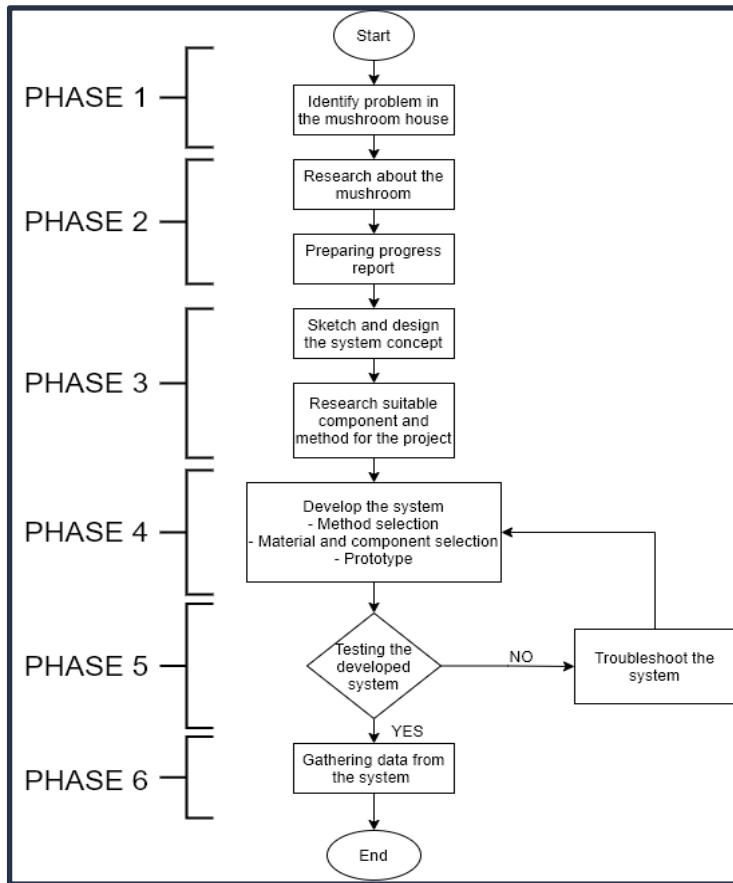
Area	Findings/Discussion
Grey Oyster Mushroom	<ul style="list-style-type: none"><li>• Characteristic of the grey oyster mushroom</li><li>• Life Cycle of the oyster mushroom</li><li>• The phase of the growth of oyster mushroom</li></ul>
Method of cultivation	<ul style="list-style-type: none"><li>• Discuss regarding conventional method of cultivation which is wood tray method and cylindrical baglog method of cultivation</li></ul>
Factor affecting the growth of mushroom	<ul style="list-style-type: none"><li>• There are two main factors which are intrinsic and extrinsic factor that will affect the growth of oyster mushroom</li><li>• Several important parameters are determined that can affect the growth of the mushroom.</li></ul>
Disease affecting mushroom yield	<ul style="list-style-type: none"><li>• The common disease has affected the production of mushroom can be determined.</li><li>• The symptom of the disease is determined and the causes also being discussed in the literature review.</li></ul>
Sensor	<ul style="list-style-type: none"><li>• Temperature and humidity, carbon dioxide sensor is a common sensor that is used to monitor the mushroom house.</li><li>• Due to the compatibility to microcontroller, it is commonly being used among researcher</li></ul>
Data transmission	<ul style="list-style-type: none"><li>• The uses of several types of module to communicate.</li><li>• NodeMCU ESP32 have a built-in WI-FI module which enable the system to connect with the Internet</li><li>• The implementation of Wireless sensor network (WSN)</li><li>• LORA and GSM can also be used for the area that have low internet connectivity.</li></ul>
Neural Network Techniques	<ul style="list-style-type: none"><li>• The advantages and disadvantages for several types of neural network techniques.</li><li>• The implementation of fuzzy logic system for the control mechanism.</li><li>• Method to setup fuzzy logic system.</li><li>• Method to calibrate and validate the fuzzy logic system</li></ul>

# 4

## METHODOLOGY

FLOW OF THE PROJECT & SYSTEM  
OVERVIEW

# Working Flow Of The Project



## PHASE 1 – PHASE 2

- ❑ Problem need to identify and research about the mushroom cultivation before preparing progress report.

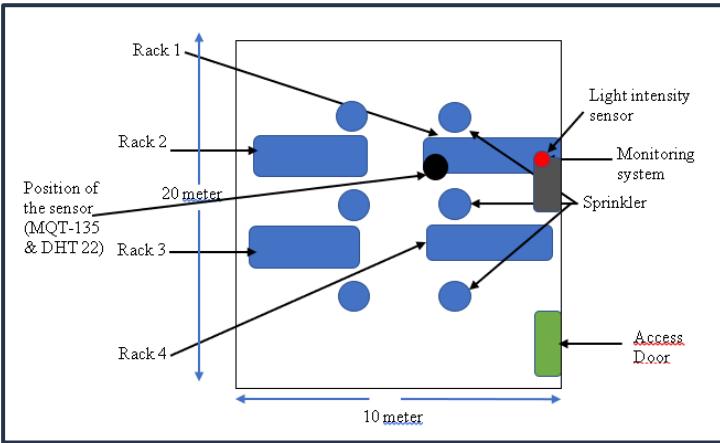
## PHASE 3 – PHASE 4

- ❑ The concept of the system is sketch and design and research several suitable component. Finally development of the system

## PHASE 5 – PHASE 6

- ❑ Testing and troubleshooting phase for the system and gather data from the system

# Mushroom House Design



## Design of the Mushroom House

- The size of the mushroom house is 20meter x 10meter.
- Height of the mushroom house is 4 meter height.
- Total racks inside the mushroom house is 4 racks





# COMPONENT SELECTION

## Power Supply

- To supply DC input for the NODEMCU and other electronic component
- Provide stable 5V to the whole system



## NODEMCU esp32

- Allow the system to connect with the Internet
- Low power consumption with high processing power



## DHT-22 sensor

- Sensor for Temperature and Humidity
- Better accuracy with optimum range of measurement





## COMPONENT SELECTION

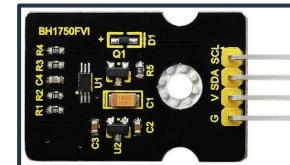
### MQ-135

- Air quality sensor to detect the concentration of carbon dioxide
- Able to detect carbon dioxide gasses from 350ppm – 5000ppm

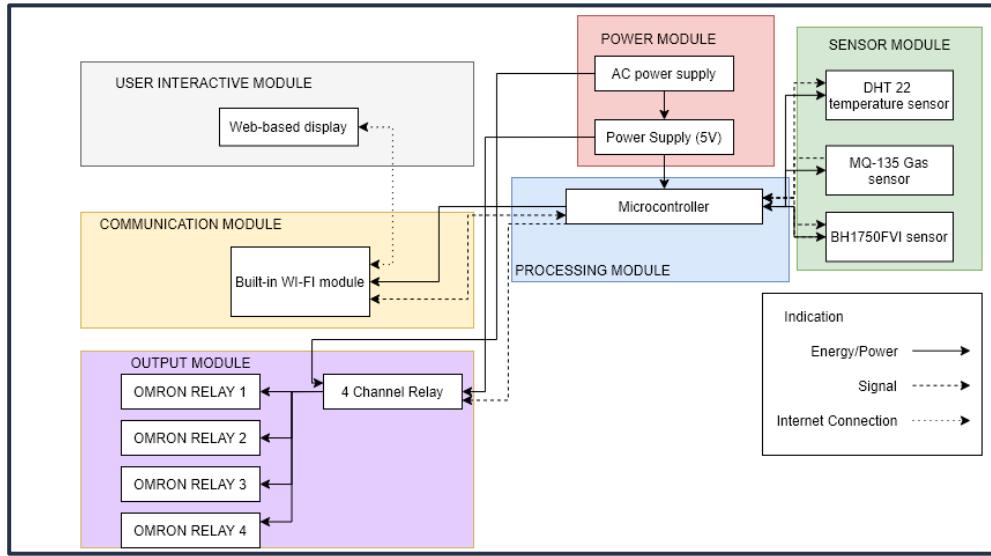


### BH1750FVI

- Light Intensity sensor to detect the light intensity inside the mushroom house.
- Able to detect the light intensity from the range of 1 – 65535 lux.



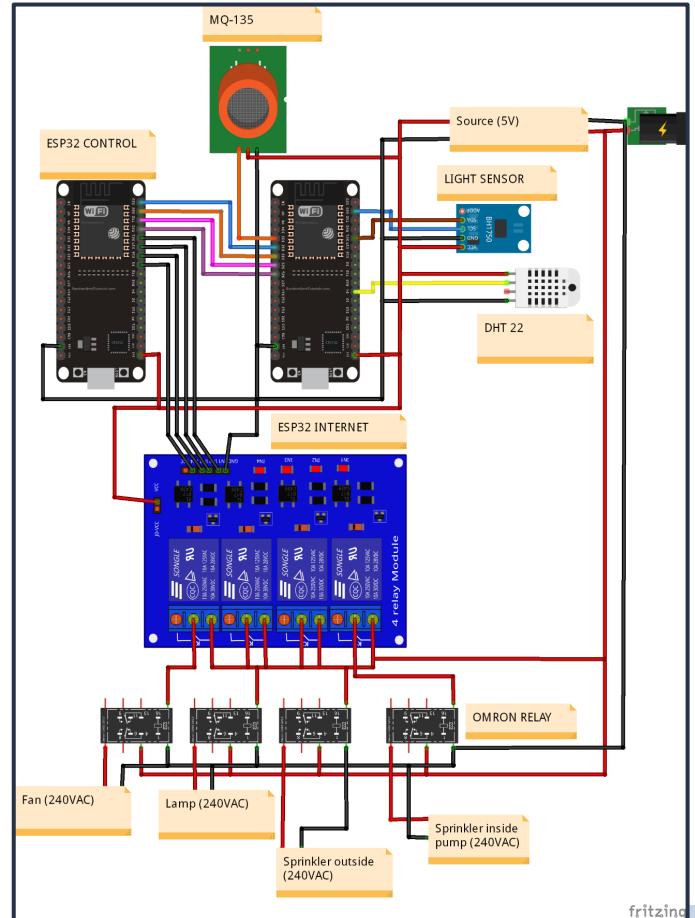
# System Architecture



## Block Diagram

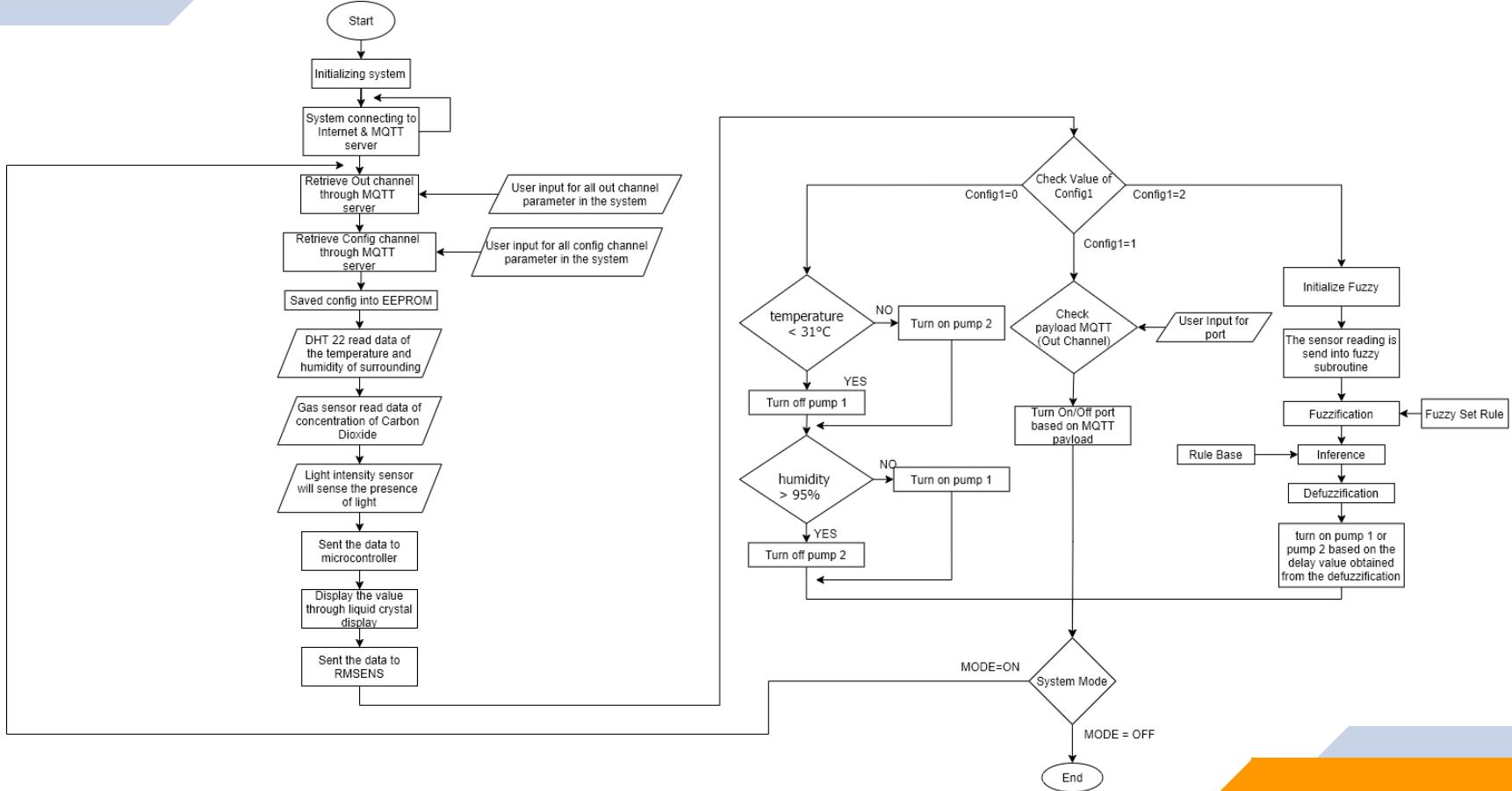
Consists of 5 component which is:-

1. User interactive module
2. Communication module
3. Processing module
4. Sensor module
5. Power module
6. Output module



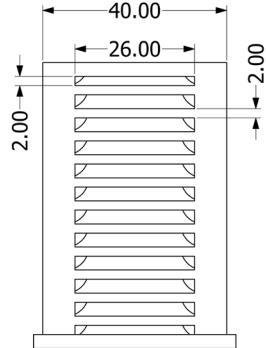
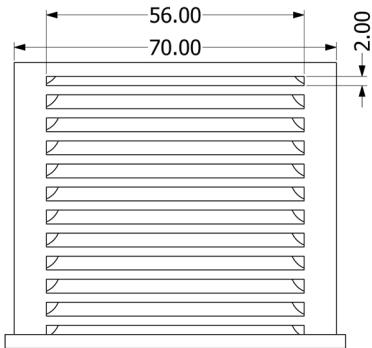
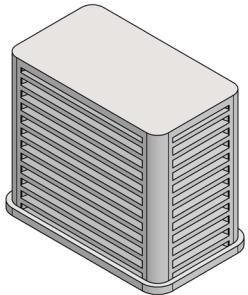
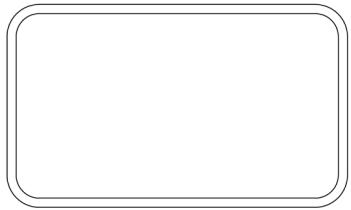
fritzing

# Working Flow Of The System





# DEVELOPMENT OF THE SENSOR CASE



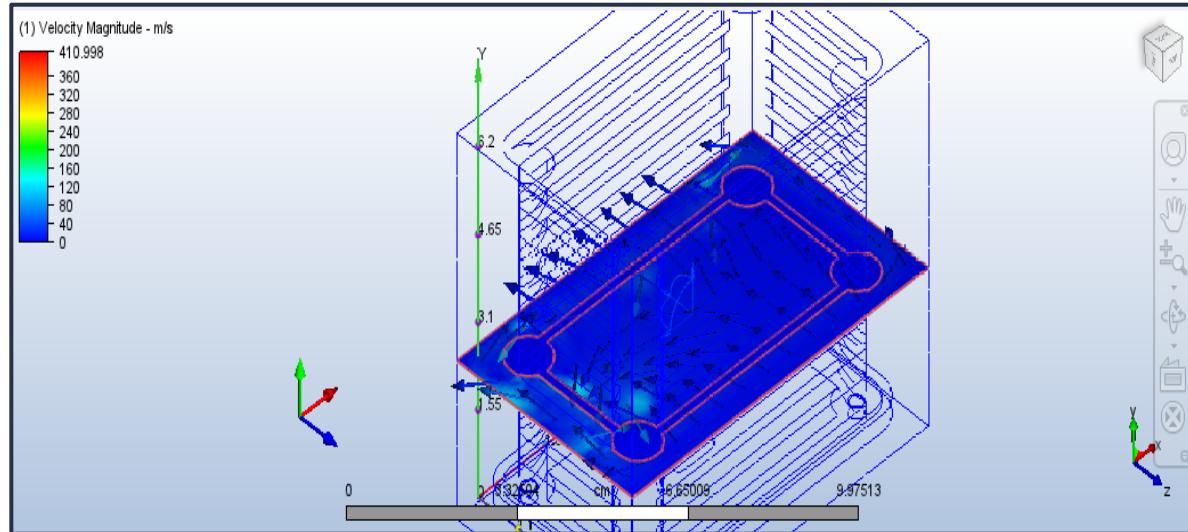
## Development of the Sensor Case

### Design Consideration:-

- Prevent water directly entered the sensor case if the mist sprinkler turned on.
- Allow the sensor to take the reading of the carbon dioxide, temperature and the humidity inside the mushroom house.

# Simulation Result (Computational Fluid Dynamics)

## Computational Fluid Dynamics Simulation Result (Plane X)

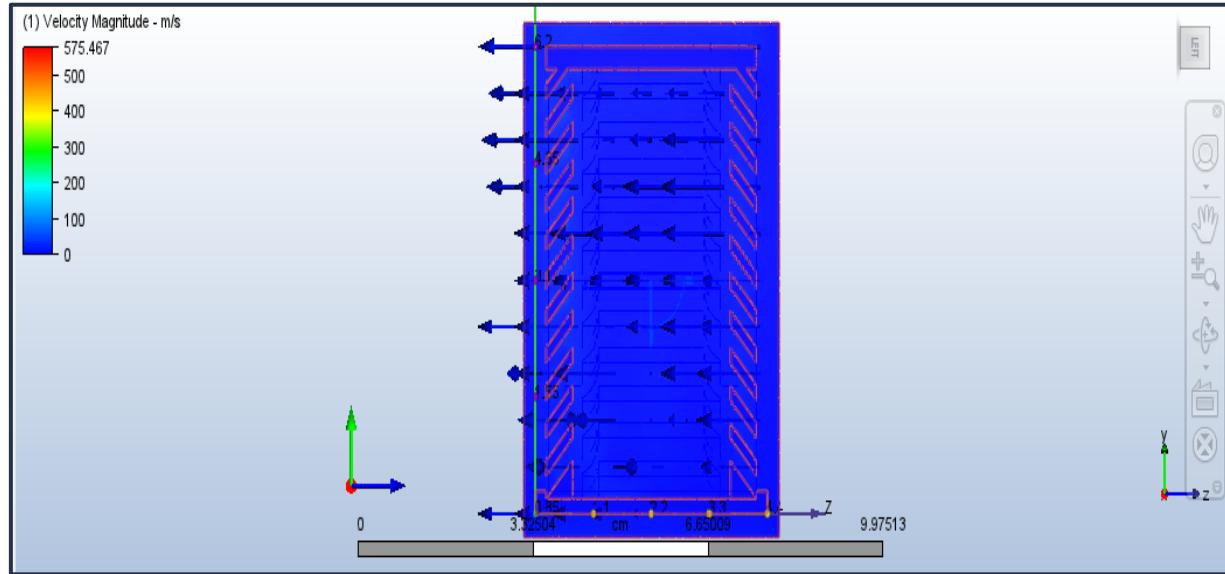


### Simulation Result:

- The movement of the air is represented through the arrow of the vector
- It shows if the air flow through the side of the sensor case, it will either move through the sensor or turn to the left of the casing.
- Therefore, the sensor are capable to sense the environment parameter

# Simulation Result (Computational Fluid Dynamics)

## Computational Fluid Dynamics Simulation Result (Plane Y)

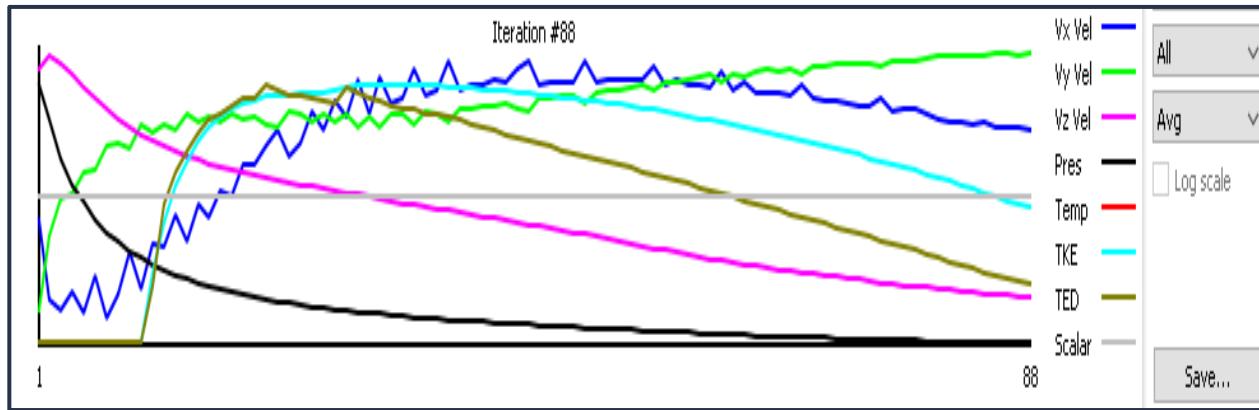


### Simulation Result:

- Further analysis is done through Plane Y where it can be seen that the movement of the air is presented using the vector.
- The air is moving from the outside(right side) into the sensor case and move out(left side) of the sensor case.

# Simulation Result (Computational Fluid Dynamics)

## Computational Fluid Dynamics Simulation Result (Plot vector)



## Simulation Result:

- The movement of the air inside the sensor case is computed and the result is presented as in the graph.
- It shows that the velocity of Vector x and y able to achieve the high speed will the Vector z decreases over time.
- This is because the bottom of the sensor case is secure which causes the air does not flow through Z –axis.

# 5

## RESULT AND DISCUSSION

PROJECT OUTPUT



# OBJECTIVE ONE

To acquire the temperature, humidity and concentration of carbon dioxide in the mushroom house

**IOT INSAT**

MAP LOGIN SIGNUP

**4 AIR QUALITY - SP SAUJANA** 2022-06-27 01:48:32

**5 GPS TRACKER 1**

**6 Tunjang**

**7 MUSHROOM HOUSE 1** 2022-06-27 01:48:44

**ONLINE DATA**

**808413af MUSHROOM HOUSE 1**

PARAMETER NAME	VALUE	UNIT
Temperature	26.70	C
Humidity	87.30	%
Carbon Dioxide	272	ppm
Light	0	lux

**RAW DATA**

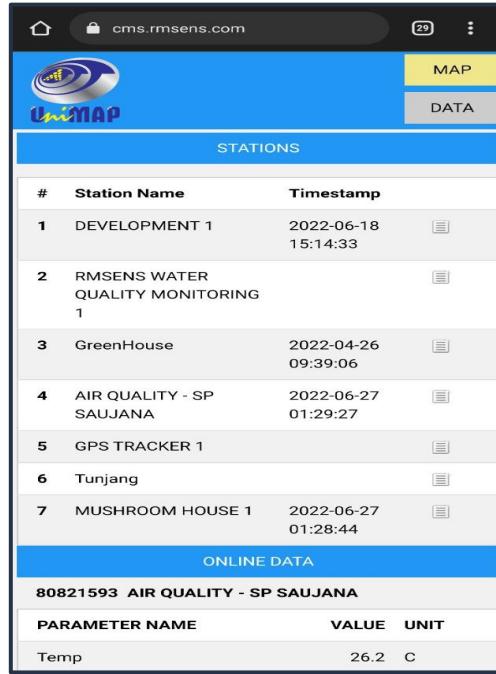
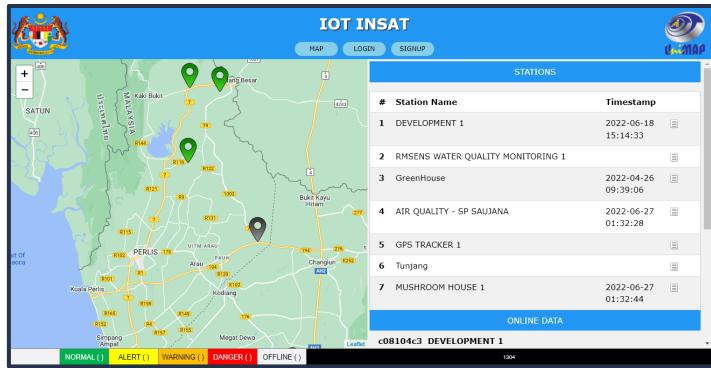
NORMAL () ALERT () WARNING () DANGER () OFFLINE () Leaflet

- The system able to acquire the reading of the temperature, humidity, concentration of carbon dioxide and light intensity inside the mushroom house.
  - The system will post the data into the INSAT IOT system or through the serial terminal of the ESP32.



## OBJECTIVE TWO

To develop a micro-controller-based that can monitor and control the system using (IoT)



- The system is build using micro-controller based which is ESP32 microcontroller.
- The system can be monitored through the INSAT IOT system which the temperature, humidity, concentration of carbon dioxide and the light intensity is display inside the system.

# OBJECTIVE TWO

The screenshot shows the IOT INSAT system interface. On the left is a map of the Malaysian state of Perlis, showing roads, towns like Arau, PAUH, and Kodiang, and geographical features like the Strait of Malacca. Two green location markers are placed near Kaki Bukit and Lang Besar. On the right is a configuration panel titled "DEVICE EEPROM CONFIGURATION". It contains a table with two columns: "NAME" and "VALUE". There are eight rows, each with a "SEND" button next to the value input field. The values are as follows:

NAME	VALUE
CONFIG 1	1
CONFIG 2	33
CONFIG 3	29
CONFIG 4	90
CONFIG 5	85
CONFIG 6	0
CONFIG 7	0
CONFIG 8	0

At the bottom of the interface, there is a navigation bar with buttons for "NORMAL ()", "ALERT ()", "WARNING ()", "DANGER ()", and "OFFLINE ()". The "DANGER ()" button is highlighted in red. The status code "1304" is displayed at the bottom right.

- The system has three type of mode which is
  - Manual control mode
  - Simple Logic Control
  - Fuzzy logic System
- Configuration of the mode is made at CONFIG 1.
- (0) – Simple Logic Control
- (1) – Manual Control
- (2) – Fuzzy Logic Control

# OBJECTIVE TWO

The screenshot shows the IOT INSAT interface. On the left is a map of a region in Malaysia, specifically showing parts of Satun, Kaki Bukit, Lang Besar, and Bukit Kayu Hitam. There are several green location markers on the map. To the right of the map is a table titled "DEVICE EEPROM CONFIGURATION". The table has two columns: "NAME" and "VALUE". It contains five rows labeled CONFIG 1 through CONFIG 5, each with a text input field and a "SEND" button.

NAME	VALUE
CONFIG 1	1
CONFIG 2	33
CONFIG 3	29
CONFIG 4	90
CONFIG 5	85

- Manual Control Mode
- The system mode need to set 1 at its config 1 to allow manual control mode.
- Allow farmer to activate the pump for both sprinkler manually through the INSAT IOT system.

The screenshot shows the IOT INSAT interface with a "DATA VIEW FROM 07/04/2022" and "TO 30/04/2022" timeline. Below the timeline are two rows of buttons for inputs (INP0-INP7) and outputs (OUT0-OUT7). The first row of buttons is labeled "ON" and the second row is labeled "OFF". At the bottom of the interface, there is a legend: Temperature (red), Humidity (green), Carbon Dioxide (blue), and Light (yellow). The text "MUSHROOM HOUSE" is also present at the bottom.

# OBJECTIVE TWO

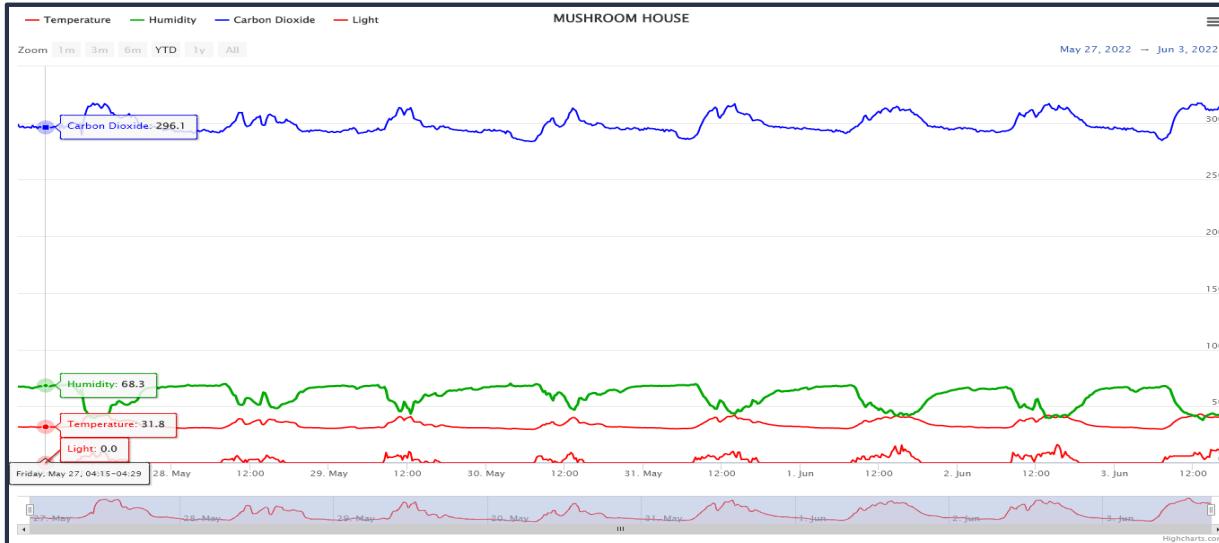
The screenshot shows the IOT INSAT system interface. At the top, there is a blue header bar with the text "IOT INSAT" in white. On the left side of the header is the coat of arms of Malaysia. On the right side are "MAP" and "LOGOUT" buttons. Below the header is a map of the northern part of Malaysia, specifically the states of Satun, Kedah, Perlis, and Negeri Sembilan. The map shows several roads labeled with route numbers such as R106, R144, R116, R9, R122, R102, R131, R79, R194, R276, R102, R1, R139, R102, R165, R159, R149, R176, R84, R157, R155, and R152. There are also labels for towns like Lang Besar, Kaki Bukit, Bukit Kayu Hitam, Arau, PAUH, Changlun, AH2, Kuala Perlis, Simpang Ampat, and Megat Dewa. A legend at the bottom indicates five levels of status: NORMAL (green), ALERT (yellow), WARNING (orange), DANGER (red), and OFFLINE (black). The main content area is titled "DEVICE EEPROM CONFIGURATION". It contains a table with two columns: "NAME" and "VALUE". The table has 8 rows, each corresponding to a configuration item from CONFIG 1 to CONFIG 8. Each row has an input field for the value and a "SEND" button. The values are: CONFIG 1: 0, CONFIG 2: 33, CONFIG 3: 29, CONFIG 4: 90, CONFIG 5: 85, CONFIG 6: 0, CONFIG 7: 0, and CONFIG 8: 0.

NAME	VALUE
CONFIG 1	0
CONFIG 2	33
CONFIG 3	29
CONFIG 4	90
CONFIG 5	85
CONFIG 6	0
CONFIG 7	0
CONFIG 8	0

- Simple Logic Control Mode
- The mode of the system need to set to 0 to allow the system changed the mode to simple logic control mode.
- This mode will turned on the pump for sprinkler outside if the temperature is higher than value in config 2 and turn off if it is below the value of config 3.
- It will turned on the pump for sprinkler inside if the humidity is below the value in config 5 and turn off if the value is higher than config 4.

# OBJECTIVE TWO

Data collection is performed on 27 May 2022 to 3 Jun 2022



No.	Parameter	Average Value	Highest Value	Lowest Value
1	Temperature(°C)	34.35	43.20	29.10
2	Humidity (%)	58.83	71.60	36.80
3	Carbon Dioxide (ppm)	299.75	340.00	254.00
4	Light Intensity (lux)	2.32	20.00	0

- Fuzzy Logic Control System
- For this control system, the data is analyzed in order to generate fuzzy logic control system.
- Therefore, the data collection is performed on 27 May 2022 – 3 Jun 2022.

# OBJECTIVE TWO

Data analysis from the data collection (27 May 2022 to 3 Jun 2022)

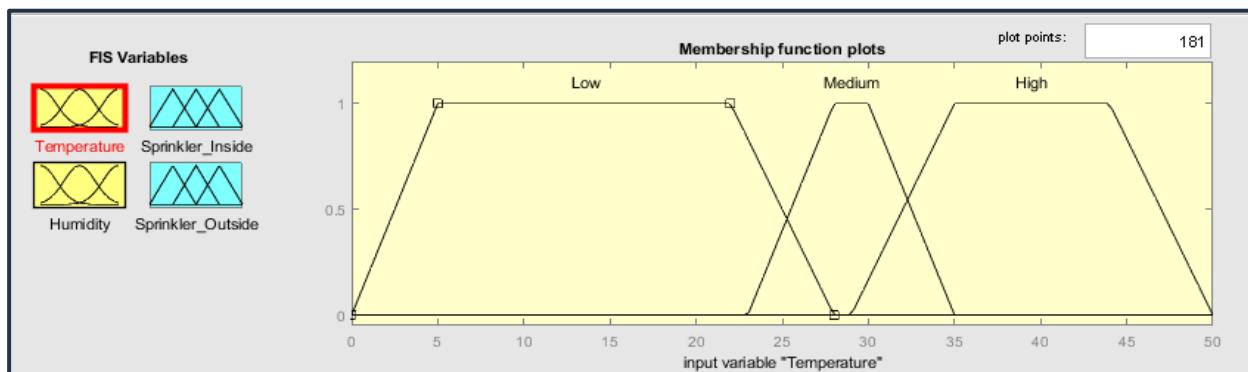
Range Value		Day						
		1	2	3	4	5	6	7
Temperature (°C)	Morning	30.4 - 39.1	30.4 - 39.1	30.4 - 39.1	30.4 - 39.2	30.4 - 39.1	30.4 - 39.1	30.4 - 39.3
	Evening	33.5 - 38.5	33.2 - 38.5	32.9 - 40.5	32.6 - 43.2	32.4 - 38.5	32.2 - 42.0	32 - 38.5
	Night	30.5 - 35.1	30.5 - 35.2	32.9 - 34.9	30.5 - 34.8	30.5 - 34.1	30.5 - 33.6	30.5 - 33.2
Humidity (%)	Morning	47.5 - 70	47.5 - 71	47.5 - 71.6	47.5 - 71.3	47.5 - 70.5	47.5 - 70.6	47.5 - 70.9
	Evening	46.7 - 63.1	46.7 - 63.2	38.9 - 63.3	36.8 - 63.4	46.7 - 63.5	37.8 - 63.6	46.7 - 63.7
	Night	58.4 - 68.6	58.4 - 68.7	58.4 - 68.8	58.4 - 68.9	58.4 - 68.10	58.4 - 68.11	58.4 - 68.12
Light Intensity (lux)	Morning	0 - 10	0 - 10	0 - 10	0 - 10	0 - 10	0 - 10	0 - 10
	Evening	0 - 10	0 - 10	0 - 10	0 - 10	0 - 10	0 - 10	0 - 10
	Night	0	0	0	0	0	0	0
Carbon Dioxide (ppm)	Morning	284 - 314	284 - 314	284 - 314	284 - 314	284 - 314	284 - 314	284 - 314
	Evening	291 - 312	291 - 312	291 - 312	291 - 312	291 - 312	291 - 312	291 - 312
	Night	283 - 304	283 - 304	283 - 304	283 - 299	283 - 299	283 - 298	283 - 298

- Data collection from 27 May 2022 – 3 Jun 2022 is further analyze by daily.
- There are three type of period which is Morning, Evening and Night.
- Morning : 6.30 am to 11.59 am
- Evening : 12.00 pm to 7.30 pm
- Night : 7.31 pm to 6.29 am

# OBJECTIVE TWO

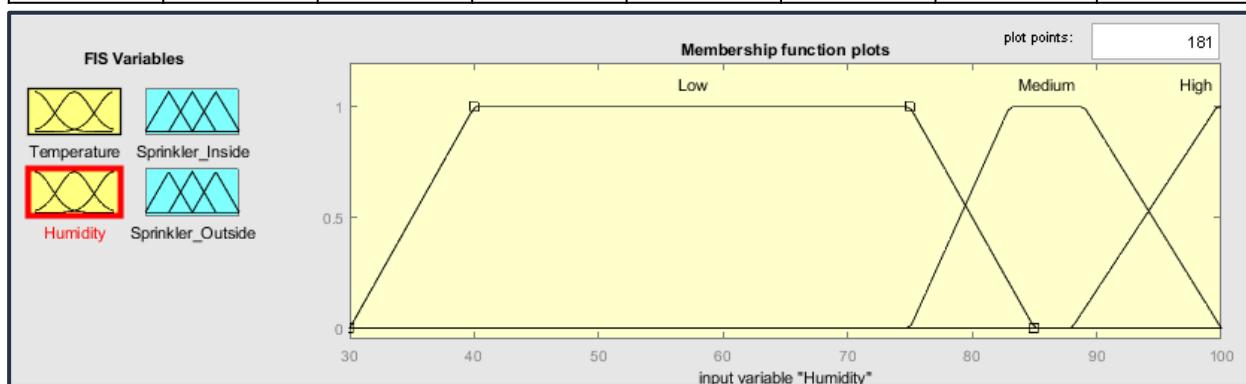
Temperature (°C)	Day						
	1	2	3	4	5	6	7
Morning	30.4 LOW						
	- -						
	39.1 HIGH						
	HIGH						
Evening	33.5 MEDIUM	33.2 MEDIUM	32.9 MEDIUM	32.6 MEDIUM	32.4 MEDIUM	32.2 MEDIUM	32 MEDIUM
	- -						
	38.5 HIGH	38.5 HIGH	40.5 HIGH	43.2 HIGH	38.5 HIGH	42.0 HIGH	38.5 HIGH
	HIGH						
Night	30.5 MEDIUM	30.5 MEDIUM	32.9 MEDIUM	30.5 MEDIUM	30.5 MEDIUM	30.5 MEDIUM	30.5 MEDIUM
	- -						
	35.1 HIGH	35.2 HIGH	34.9 MEDIUM	34.8 MEDIUM	34.1 MEDIUM	33.6 MEDIUM	33.2 MEDIUM
	HIGH	HIGH	MEDIUM	MEDIUM	MEDIUM	MEDIUM	MEDIUM

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# OBJECTIVE TWO

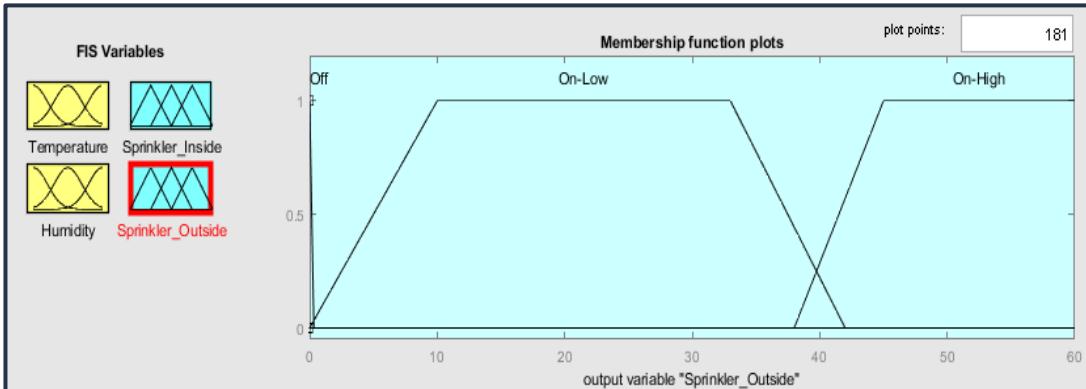
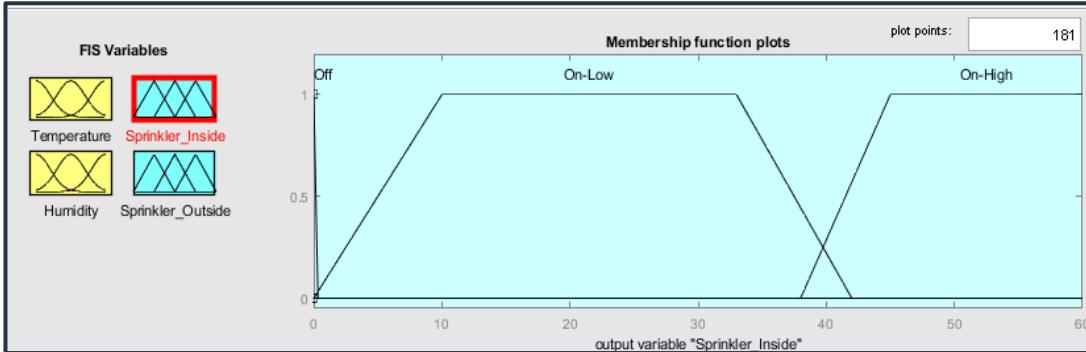
Humidity (%)	Day						
	1	2	3	4	5	6	7
Morning	47.5 LOW	47.5 LOW	47.5 LOW	47.5 LOW	47.5 LOW	47.5 LOW	47.5 LOW
	- -	- -	- -	- -	- -	- -	- -
	70 LOW	71 LOW	71.6 LOW	71.3 LOW	70.5 LOW	70.6 LOW	70.9 LOW
Evening	46.7 LOW	46.7 LOW	38.9 LOW	36.8 LOW	46.7 LOW	37.8 LOW	46.7 LOW
	- -	- -	- -	- -	- -	- -	- -
	63.1 LOW	63.2 LOW	63.3 LOW	63.4 LOW	63.5 LOW	63.6 LOW	63.7 LOW
Night	58.4 LOW	58.4 LOW	58.4 LOW	58.4 LOW	58.4 LOW	58.4 LOW	58.4 LOW
	- -	- -	- -	- -	- -	- -	- -
	68.6 LOW	68.7 LOW	68.8 LOW	68.9 LOW	68.10 LOW	68.11 LOW	68.12 LOW



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- Night : 7.31 pm to 6.29 am

# OBJECTIVE TWO

Output	Time (second)	
	On-low	On-high
Sprinkler Inside	0 - 40	40 - 60
Sprinkler Outside	0 - 40	40 - 60



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- Morning : 6.30 am to 11.59 am
- Evening : 12.00 pm to 7.30 pm
- Night : 7.31 pm to 6.29 am

# OBJECTIVE TWO

Input (Temperature & Humidity)		Temperature (°C)		
		low	medium	high
Humidity	low	Off	On-low	On-high
	medium	Off	On-low	On-high
	high	Off	On-low	On-high

Input (Temperature & Humidity)		Temperature (°C)		
		low	medium	high
Humidity	low	On-high	On-high	On-high
	medium	On-low	On-low	On-low
	high	Off	Off	Off

1. If (Temperature is High) and (Humidity is Low) then (Sprinkler\_Inside is On-High)(Sprinkler\_Outside is On-High) (1)  
 2. If (Temperature is Medium) and (Humidity is Low) then (Sprinkler\_Inside is On-High)(Sprinkler\_Outside is On-Low) (1)  
 3. If (Temperature is High) and (Humidity is Medium) then (Sprinkler\_Inside is On-Low)(Sprinkler\_Outside is On-High) (1)  
 4. If (Temperature is Medium) and (Humidity is High) then (Sprinkler\_Inside is Off)(Sprinkler\_Outside is On-Low) (1)  
 5. If (Temperature is Medium) and (Humidity is Medium) then (Sprinkler\_Inside is On-Low)(Sprinkler\_Outside is On-Low) (1)  
 6. If (Temperature is Low) and (Humidity is High) then (Sprinkler\_Inside is Off)(Sprinkler\_Outside is Off) (1)  
 7. If (Temperature is Low) and (Humidity is Medium) then (Sprinkler\_Inside is On-Low)(Sprinkler\_Outside is Off) (1)  
 8. If (Temperature is Low) and (Humidity is Low) then (Sprinkler\_Inside is On-High)(Sprinkler\_Outside is Off) (1)  
 9. If (Temperature is High) and (Humidity is High) then (Sprinkler\_Inside is Off)(Sprinkler\_Outside is On-High) (1)

The screenshot shows a software interface for defining rules. A list of 9 rules is displayed at the top, each consisting of an 'If' condition and a 'Then' action. The 'If' condition for rule 1 is '(Temperature is High) and (Humidity is Low)'. The 'Then' action for rule 1 is '(Sprinkler\_Inside is On-High)(Sprinkler\_Outside is On-High)'.

The interface includes dropdown menus for selecting conditions and actions, and checkboxes for 'not' and 'Connection' (set to 'and'). Buttons at the bottom include 'Delete rule', 'Add rule', 'Change rule', and navigation arrows.

If Condition	Then Action
Temperature is Low Medium <b>High</b> none	Sprinkler_Inside is Off On-Low <b>On-High</b> none
Humidity is Low Medium High none	Sprinkler_Outside is Off On-Low <b>On-High</b> none

Buttons at the bottom: Connection (radio buttons for 'or' and 'and'), Weight: 1, Delete rule, Add rule, Change rule, <<, >>.

- Data collection from 27 May 2022 – 3 Jun 2022 is further analyze by daily.
- There are three type of period which is Morning, Evening and Night.
- Morning : 6.30 am to 11.59 am
- Evening : 12.00 pm to 7.30 pm
- Night : 7.31 pm to 6.29 am

# OBJECTIVE TWO

## Result from Simulation for MATLAB and ESP32

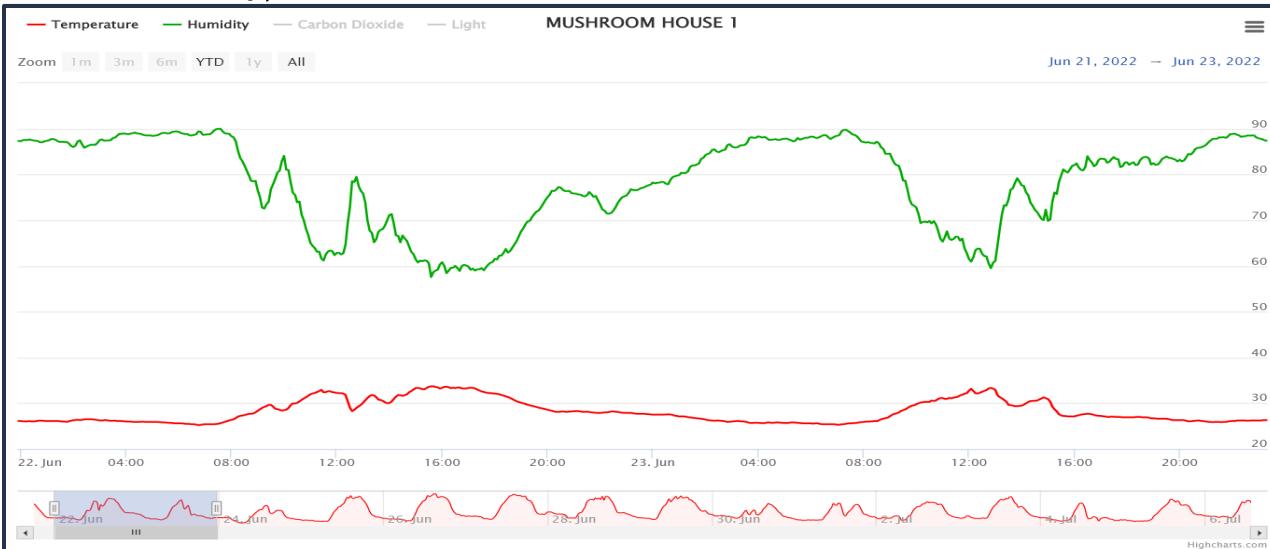
Period	Parameter (Average value)	
	Temperature (°C)	Humidity (%)
Morning (6.30am – 11.59am)	33.9	61.92
Evening (12.00 am – 7.29 pm)	36.39	53.21
Night (7.30 pm – 11.59 am)	31.10	66.44
Midnight (12.00am – 6.49 am)	28.8	87.80

Period	MATLAB toolbox		ESP32 microcontroller		Difference (%)	
	Sprinkler Inside (s)	Sprinkler Outside (s)	Sprinkler Inside (s)	Sprinkler Outside (s)	Sprinkler Inside	Sprinkler Outside
Morning	50.5	50.5	40.2	51.12	22.71	1.22
Evening	50.8	50.8	40.02	51.12	23.73	0.63
Night	50.2	22.1	50.54	17.66	0.67	22.33
Midnight	19.7	21.2	17.12	17.12	14.01	21.29

- Data collection from 27 May 2022 – 3 Jun 2022 is further analyze by daily.
- There are three type of period which is Morning, Evening and Night.
- Morning : 6.30 am to 11.59 am
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- Night : 7.31 pm to 6.29 am

# OBJECTIVE TWO

## System Output After Implementation of Fuzzy System (Temperature and Humidity)

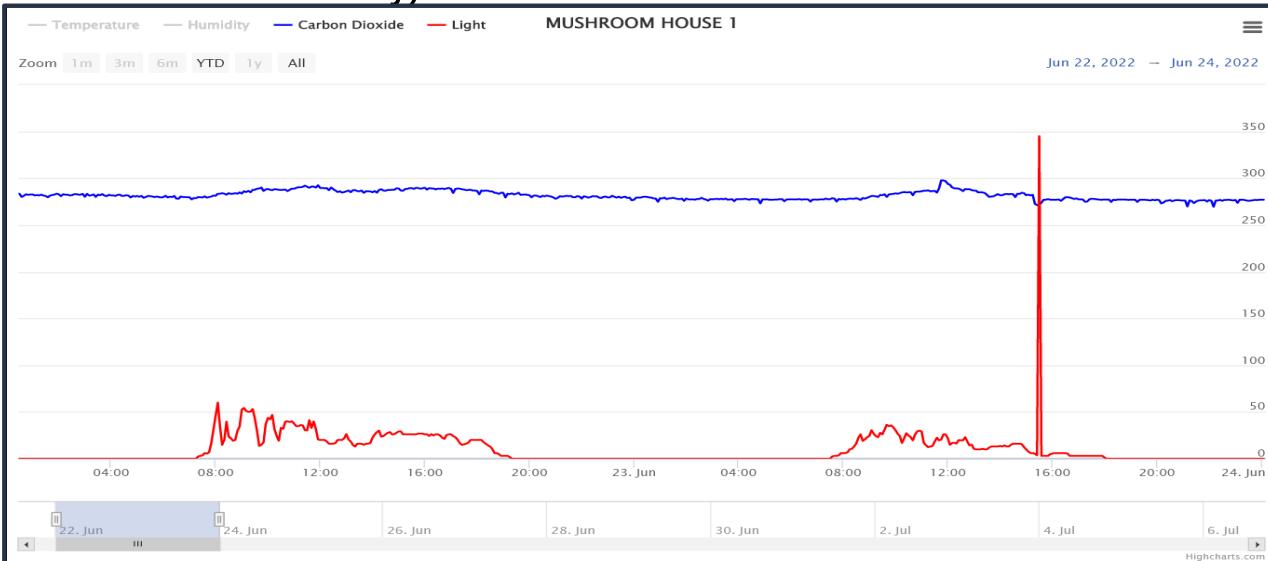


- Data collection from 27 May 2022 – 3 Jun 2022 is further analyze by daily.
- There are three type of period which is Morning, Evening and Night.
- Morning : 6.30 am to 11.59 am
- Evening : 12.00 pm to 7.30 pm
- Night : 7.31 pm to 6.29 am

Statistical Variable	Temperature (°C)	Humidity(%)
Average	28.14	78.67
Max	33.70	90.10
Min	25.20	60.50

# OBJECTIVE TWO

## System Output After Implementation of Fuzzy System (Carbon Dioxide and Humidity)



- Data collection from 27 May 2022 – 3 Jun 2022 is further analyze by daily.
- There are three type of period which is Morning, Evening and Night.
- Morning : 6.30 am to 11.59 am
- Evening : 12.00 pm to 7.30 pm
- Night : 7.31 pm to 6.29 am

Statistical Variable	Carbon Dioxide (ppm)	Light Intensity (lux)
Average	281.45	9.73
Max	299.00	1713.00
Min	259.00	0

# OBJECTIVE TWO

## Comparison between Simple Logic Control System and Fuzzy System

Environment Parameter	Temperature (°C)		Humidity (%)		Carbon Dioxide (ppm)		Light Intensity (lux)	
Statistical Variable	Initial	Final	Initial	Final	Initial	Final	Initial	Final
Average	34.29	28.14	62.19	78.67	299.75	281.44	1.44	9.73
Maximum	42.70	33.70	98.60	90.10	340.00	299.00	140.00	1713.00
Minimum	30.00	25.20	38.50	60.50	254.00	259.00	0	0

- The system only control temperature and the humidity
- Average reading of temperature drop by 19.70%
- Average reading of humidity increase by 23.40%

# OBJECTIVE TWO

## First Batch of Mushroom Production

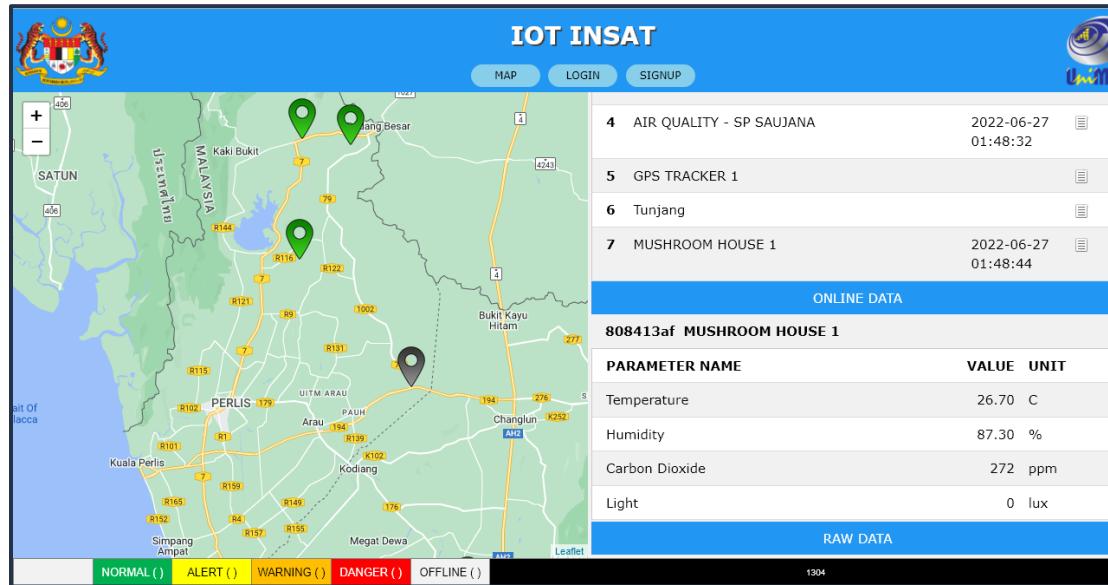


- The system only control temperature and the humidity
- Average reading of temperature drop by 19.70%
- Average reading of humidity increase by 23.40%



## OBJECTIVE THREE

To develop a system that can display real-time data from a web-based system.



- The system able to display the real-time data from the web based system.
- The system will shows the temperature, humidity, carbon dioxide concentration and the light intensity with the timestamp when the data is updated in the system.

# 6

## CONCLUSION AND FUTURE WORKS

CONCLUSION OF THE PROJECT AND  
FUTURE WORKS

# CONCLUSION AND FUTURE WORKS

- The mushroom house monitoring system and Environment Control System using IoT is developed to help the farmer handle and manage their mushroom house effectively.
- The first objective has achieve as the system able to acquire the reading of temperature, humidity, concentration of the carbon dioxide and the light intensity.
- Second objective also achieve as the farmer able to control the system through IoT system using different type of modes.
- Third objective achieve as the system to display the real time data through web-based system which is the INSAT IOT system.
- The system is tested and currently being used by Institute of Sustainable Agriculture (INSAT) UniMAP for their mushroom house production as first batch of mushroom has been produced by using this system.
- For the future works, the neural network can be implement by using data collected from this system.
- Off-grid power system or Solar power system can be implement to the system.



# 7

## PROJECT DEMONSTRATION VIDEO

DEMONSTRATION OF THE SYSTEM



# PROJECT DEMONSTRATION VIDEO

# REFERENCES

- [1] Zadrazil, F., & Kurtzman, R. H. (1982). The biology of *Pleurotus* cultivation in the tropics. Tropical Mushrooms, Biology, Nature and Cultivation Methods, ed. Chang, ST & Quimio, TH Hong Kong. Pp, 277-298.
- [2] Sánchez, C. (2010). Cultivation of *Pleurotus ostreatus* and other edible mushrooms. Applied microbiology and biotechnology, 85(5), 1321-1337.
- [3] Choi, K. W. (2004). Shelf cultivation of oyster mushroom with emphasis on substrate fermentation. In Mushroom Growers' Handbook 1. Oyster Mushrooms Cultivation. Part II: Oyster Mushrooms (pp. 153-165). MushWorld, Korea.
- [4] Bellettini, M. B., Fiorda, F. A., Maieves, H. A., Teixeira, G. L., Ávila, S., Hornung, P. S., ... & Ribani, R. H. (2019). Factors affecting mushroom *Pleurotus* spp. Saudi Journal of Biological Sciences, 26(4), 633-646.
- [5] Oei, P. (1996). Mushroom cultivation with special emphasis on appropriate techniques for developing countries.



# THANK YOU!

Any questions?



## SUMMARY OF LITERATURE REVIEW



### OVERALL SUMMARY OF LITERATURE REVIEW

Area	Findings/Discussion	References
Grey Oyster Mushroom	<ul style="list-style-type: none"><li>• Characteristic of the grey oyster mushroom</li><li>• Life Cycle of the oyster mushroom</li><li>• The phase of the growth of oyster mushroom</li></ul>	[11], [12], [13], [14], [18], [19]
Method of cultivation	<ul style="list-style-type: none"><li>• Discuss regarding conventional method of cultivation which is wood tray method and cylindrical baglog method of cultivation</li></ul>	[17], [21], [23], [24], [25], [29]



## SUMMARY OF LITERATURE REVIEW



### OVERALL SUMMARY OF LITERATURE REVIEW

Area	Findings/Discussion	References
Factor affecting the growth of mushroom	<ul style="list-style-type: none"><li>There are two main factors which are intrinsic and extrinsic factor that will affect the growth of oyster mushroom</li><li>Several important parameters are determined that can affect the growth of the mushroom.</li></ul>	[17], [31], [32], [33], [35], [36], [39], [41], [42], [44], [45]
Disease affecting mushroom yield	<ul style="list-style-type: none"><li>The common disease has affected the production of mushroom can be determined.</li><li>The symptom of the disease is determined and the causes also being discussed in the literature review.</li></ul>	[46],[47],[48],[49]



## SUMMARY OF LITERATURE REVIEW



### OVERALL SUMMARY OF LITERATURE REVIEW

Area	Findings/Discussion	References
Sensor	<ul style="list-style-type: none"><li>Temperature and humidity, carbon dioxide sensor is a common sensor that is used to monitor the mushroom house.</li><li>Microcontroller compatibility is being discussed</li></ul>	[56],[57],[58],[59],[60],[61],[62],[63]
Data transmission	<ul style="list-style-type: none"><li>The uses of several type of module to communicate.</li><li>NODEMCU esp32 have a build in WI-FI module which enable the system to connect with the Internet</li><li>The implementation of Wireless sensor network (WSN)</li><li>LORA and GSM can also be used for the area that have low internet connectivity.</li></ul>	[64],[65],[66],