



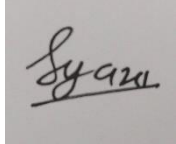
## HONOUR'S PLEDGE FORM

In our honour We, as listed & signed below, as students from the **Fakulti Teknologi Maklumat & Komunikasi (FTMK), Universiti Teknikal Malaysia Melaka (UTeM)** have neither knowingly given nor received any inappropriate assistance in academic work on this assignment, except within our group/team members, for the course **BITI 3523 AI in Robotics & Automation**. We have also not plagiarized or be complicit with those who do.

We pledge that throughout the duration of receiving this independent learning assessment task till submission, We have been honest and observed no dishonesty.

**Group Assignment (10%)**: Designing the Cockroach Hide Behavior

*CLO3: Organize solution steps in solving robotics using Artificial Intelligence concepts. (A4, PLO6, LOD C3C)*

	Team Leader	Member 1	Member 2
Signature:			
Full Names:	THIVEYA A/P MAHENDRAN	NUR SYUHADA BINTI AZHAR	NURSYAZA NISA BINTI ARFARIZAL
Matric Number:	B032010296	B032010378	B032010244
Date:	11/1/2023		

## Understanding and Analysis

This study is focused on resolving the problem of cockroach hiding behaviour by performing analysis to get a deeper understanding. Based on our knowledge, it is when the light is switched on, the cockroach conceal in behaviour resulting the cockroach to turn and run. Another behavioural of cockroach includes when the cockroach encounters a wall, the cockroach tends to move along the wall. This differs when the cockroach finds spot to hide also known as thigmotropic, it will enter the spot and faces its body outward. Furthermore, in a situation where the cockroach feels threatened, it waits until it is not terrified before reappear and emerge.

A devised plan has been created to imitate the cockroach's hide behaviour using the knowledge we understood and more information has been collected regarding this matter to help in producing Cockroach Hide Behaviour. One of the important module named Eyesim module contains Eyebot references and a RoBios-7 library function. This module was discovered and analysed in performing imitation of Cockroach conceal behaviour as it is commonly used. It was after studying the behaviour, a flowchart is created to show the flow of the system. A flowchart is made to display comparison and contrast of various behaviours.

In addition, the CAMInit function is monitored in the code section. This function works on establishing the resolution and constant sizes in bytes for the colour pictures and number of pixels. Next, the conversion of color images to grayscale is investigated. In the image processing, the usage of c\_bytes implicated in changing the colour image to grey image and combining with the constant sizes. This results to the the cockroach to behave accordingly once the grey image is detected. In other perspective, timer is examined to wait the cockroach for 10 seconds when it finds a hiding place. To measure distance, the infrared beams known as Position Sensitive Devices (PSDs) is used and PSDs will be using threshold for the behaviour functions. Furthermore, other behaviours to utilize in this study including V-Omega Driving Interface.

## Design

- **Description of task**

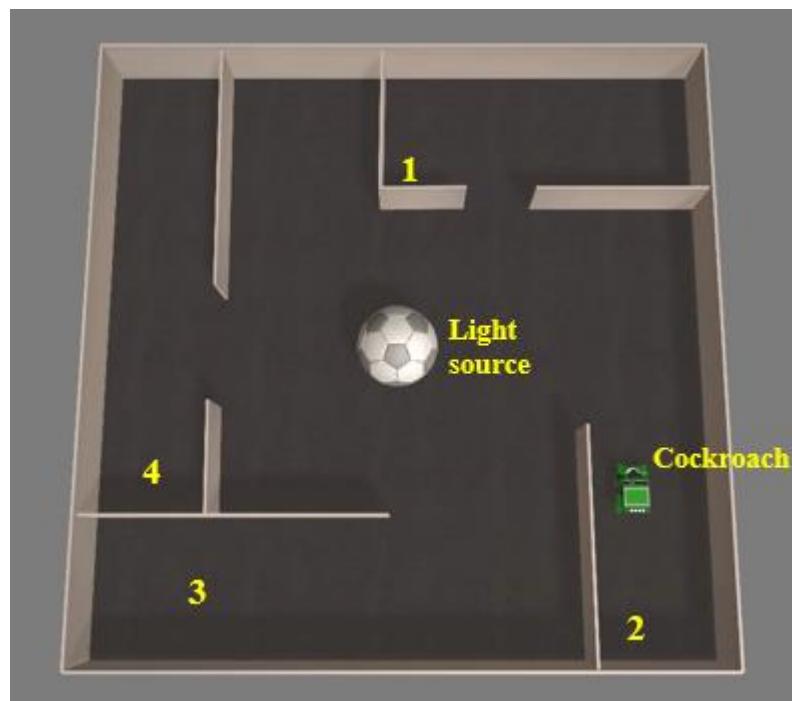
The cockroach's behaviour is to turn around and flee when the light goes on. When it gets to a wall, it follows it up while running and once it discovers a hiding spot (thigmotrophic), the cockroach goes in and faces outwards. It then waits until it is not scared to come out and also when the lights turn back off.

- **Description of robot**

The cockroach in the robot design tool simulator is represented as a green robot which is known as S4. The S4 robot is built with six sonar sensor, camera, and two wheels allowing it to move similarly like a cockroach.

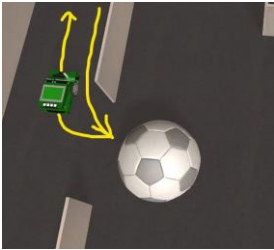
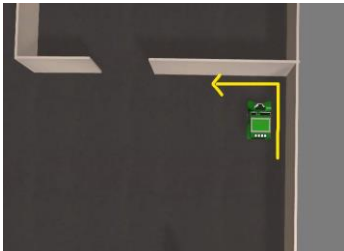
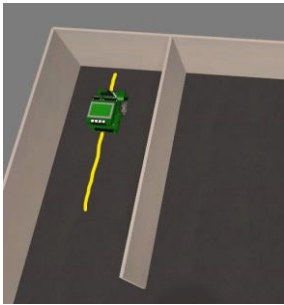
- **Description of environment**

The environment designed has four hiding places that are surrounded by walls and openings to enter and hide. On the other hand, a football is represented as the light source in this design.



**Figure 1: Cockroach Hide Behaviour Environment**

## Cockroach Hide Behaviors

<b>Flee</b> 	The cockroach (robot) will start running away from light source (football) and turns away from it steering at specific angular degrees.
<b>Follow wall</b> 	The cockroach (robot) will follow the walls if it is blocked and scared until it meets any obstacles and continues to steer forward.
<b>Hide</b> 	If the cockroach (robot) is scared and surrounded, using its sensory input, it will find a hiding place (thigmotrophic), where it will enter each one of the 4 hiding spaces and face outwards and wait to come out until it is not scared anymore or there is no any obstacles around it.

## **Challenges and Limitations of Design**

When working for this assignment, we were faced with some challenges and difficulties. Among the challenges are, we were having trouble in designing the cockroach hide behaviour and implementing it into the S4 robot. It is quite difficult to make sure that the robot follows the wall as it intends to move away from the wall. We also had trouble in adjusting the robot to make it flee away from the football (which is considered as the light source in this case) as the robot does not equipped with LiDAR sensor thus it cannot detect any light.

Besides, another challenge that we encountered was the difficulty in finding and choosing the most suitable design tool for designing the cockroach hide behaviour. This is because some of the available design tool that we found are too complex to use as we do not have much experience on how to use that simulator. There was also some other simulator that does not have the suitable robot model such as the S4 robot in the EyeSim as it is the most suitable model robot for this assignment.

## **Conclusion**

In conclusion, we are able to learn and understand more effectively about the cockroach hide behaviour from this assignment. We hope to learn more and able to implement this knowledge that we have gained in the future.

## **References**

1. EyeSim VR. (n.d.). Robotics.ee.uwa.edu.au. Eyesim VR Simulator  
<https://robotics.ee.uwa.edu.au/eyesim/>
2. Murphy, R.R. (2000). An Introduction to AI Robotics. Massachusetts Institute of Technology Press.

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