RME 40006: FINAL YEAR RESEARCH PROJECT 2 (RME)

ROAMING "NAGGER"

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CONTENT OF PRESENTATION

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BRIEF INTRODUCTION ABOUT THIS PROJECT

- The roaming “nagger” is to be deployed in a public indoor area (e.g. shopping malls and airports).
- Utilises vision-based system to detect the absence of mask wearing and/or social distancing by the citizens.
- Produce nagging messages to the citizens if they are not abide by SOP (mask wearing and social distancing).
- The prototype is to be moving freely around an indoor area, and is able to detect obstacles and reroute its moving path.

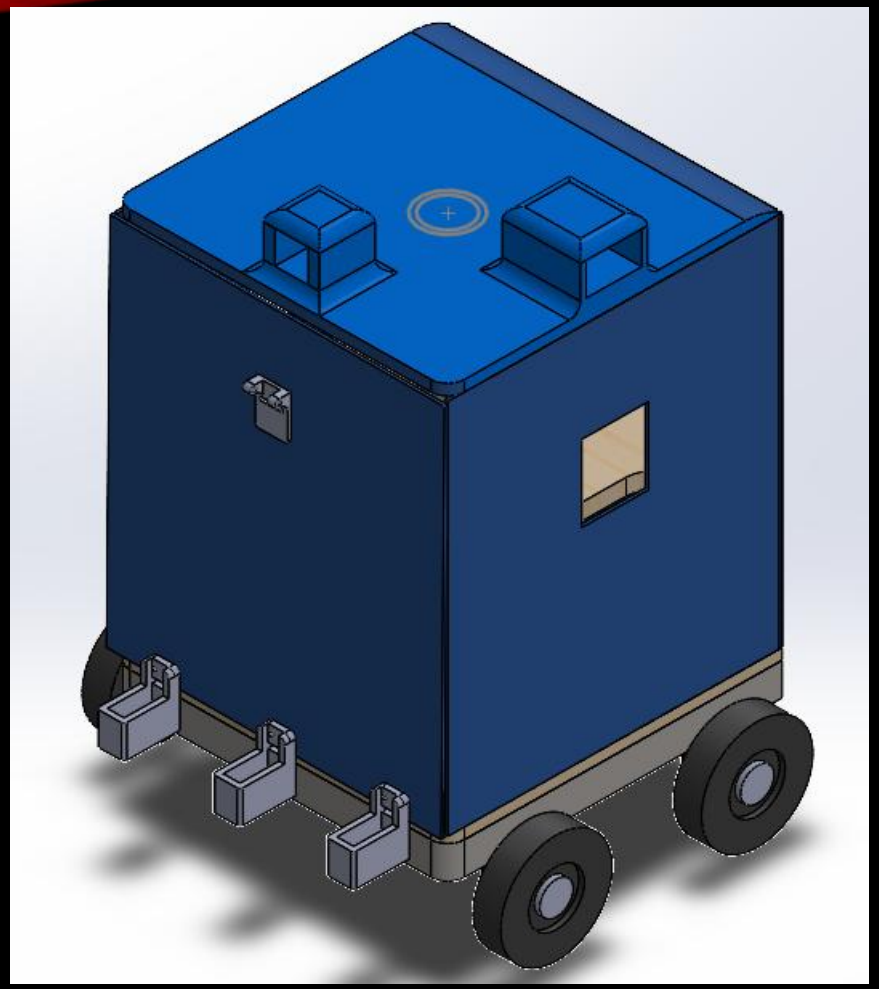
AIM OF THIS PROJECT

To design and develop a user-friendly and cost-effective roaming robot which roams around an indoor area and nags citizens who do not abide by Standard Operating Procedures(SOP) such as mask wearing or social distancing.

OBJECTIVES

- To implement the image processing algorithms to detect the absence of mask wearing or social distancing from citizens.
- To produce nagging message from the speaker to the citizens who do not abide by the Standard Operating Procedures (SOP).
- To increase the security of the roaming “nagger” by implementing an anti-theft system to prevent the robot from being carried away or stolen by any unauthorized person.
- To implement sensors for the robot to detect obstacles from the front and also the side when the robot navigates.

PROTOTYPE OVERVIEW



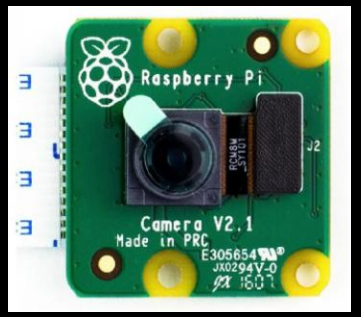
Dimension: 30cm by 30cm by 50cm

HOW THE PROTOTYPE IS PROGRAMMED

- Powered using Raspberry Pi 4B
  - ➢Controls GPIO
  - ➢Interface Pi Camera and Speakers
  - ➢Raspberry Pi 4B is powered by a 12 V rechargeable battery.

Rechargeable 12V Battery

Raspberry Pi 4B

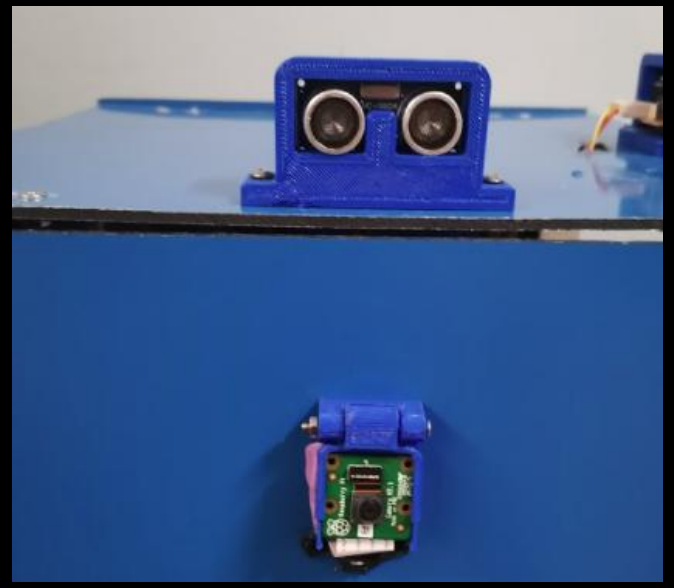


Pi Camera

Speaker

OBSTACLE DETECTION AND PATH NAVIGATION

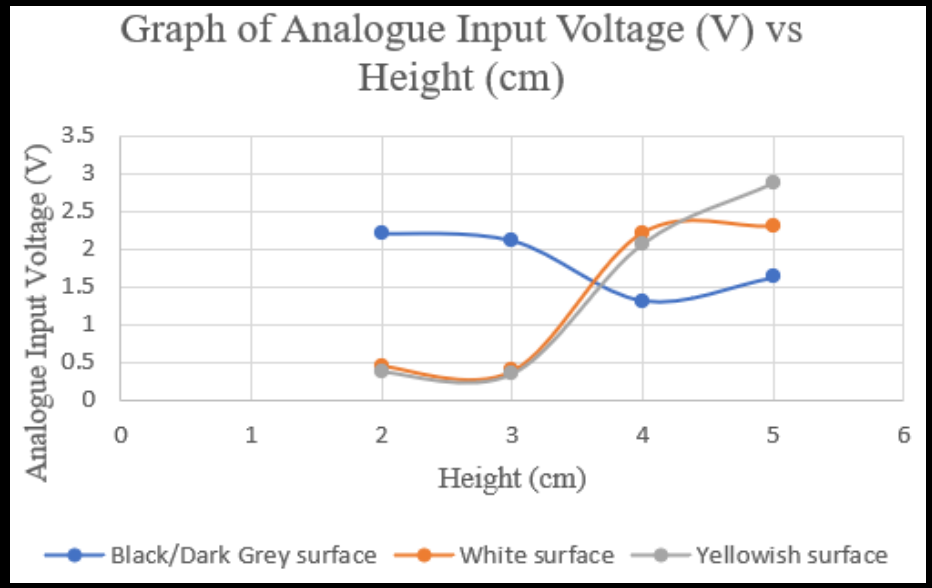
- The robot is deployed to move freely in an indoor area.
- It will turn 90 degree to the left/right when obstacle is detected (less than 55cm from the obstacle)
- Wall Detection – Detect wall from the side of robot (less than 10cm from the wall)



CLIFF DETECTION

- Utilises the 3 IR sensors in front of the robot.
- Distance between the sensors and the ground of more than 5 cm will cause the IR sensor input to drop drastically. (Normal distance: 2-3 cm)

	Input IR Sensor Voltage (V)		
	Black/ Dark Grey surface	White surface	Yellowish surface
Height, h (cm)			
2	2.21	0.447	0.363
3	2.11	0.385	0.341
4	1.31	2.21	2.06
5	1.62	2.29	2.86



SECURITY IMPLEMENTATION

- An ultrasonic sensor is placed at the bottom of the robot base, it measures the distance between the ground and the sensor.
- Distance measured increases when someone lifts up/attempts to steal the robot, thus triggering the alarm.
- Alarm can only be activated from the user program, by entering the correct password.
- Serves as an anti-theft features.

MASK DETECTION

- AI model will be trained to detect the person not wearing the mask.
- Able to detect mask of different colours (surgical mask and cloth masks can be detected).
- Conditions of not detected:

➢ No mask present on the face.

➢ When a person pulls down the mask down to his/her chin.

DEMONSTRATION VIDEO

LIMITATIONS OF THIS PROJECT

- Limitation #1 – Unable to perform a perfect 90 degree turn when placed on a non-smooth surface. (Due to budget constraint)
- Limitation #2 – Unable to perform indoor mapping using GPS system, it relies mostly on analogue sensors such as ultrasonic sensors. (Due to budget constraint)
- Limitation #3 – Unable to run a single program at the same time. Instead one program(run at desktop) is used to control the GPIO ports, and another program(run on VNC Viewer of Raspberry Pi Desktop) is used to interface the Raspberry Pi Camera and speaker (This issue is still working on)

SUMMARY OF THE PROJECT PROGRESS AND ACCOMPLISHMENT

Project Scopes/Features	Status
Allow the Robot to move freely in an area	**Accomplished**
Detect obstacles in front and at the side	**Accomplished**
Detect cliff edges/edge of elevated surface	**Accomplished**
Implementing security systems	**Accomplished**
Detect absence of mask wearing	**Accomplished but only at a limited range of distance**
Detect absence of social distancing	**Future Work**
Produce Nagging Message from the Speaker	**Accomplished**
Create Web application to stream the live video from the camera	**Future Work**

CONCLUSION AND FUTURE WORK

- Most of the features are able to work properly, with further calibrations of the turning of the robot is needed.
- Due to the limitations possessed, some of the features did not work as effectively in every conditions.
- Some of the future works include creating web application for the video to be streamed online, as well as implement both the mask and social distancing detection.

THANK YOU VERY MUCH