SMART SERVANT ROBOT

Project Report

EC6352 - EMBEDDED SYSTEMS DESIGN

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1. Introduction

The project's objective is to create a smart servant robot that can navigate an office or event space by itself and serve beverages to patrons while dodging obstructions. The robot mostly travels in a straight line, only changing course when it encounters a wall or other obstruction. It combines two essential features: motion detection to identify when someone is close by, and obstacle recognition and avoidance for safe navigation. The robot is constructed on a wheeled chassis and moves smoothly thanks to two motors. Following a predetermined route, dodging obstacles, and pausing momentarily when it senses motion to allow for interaction are all part of its primary operation.

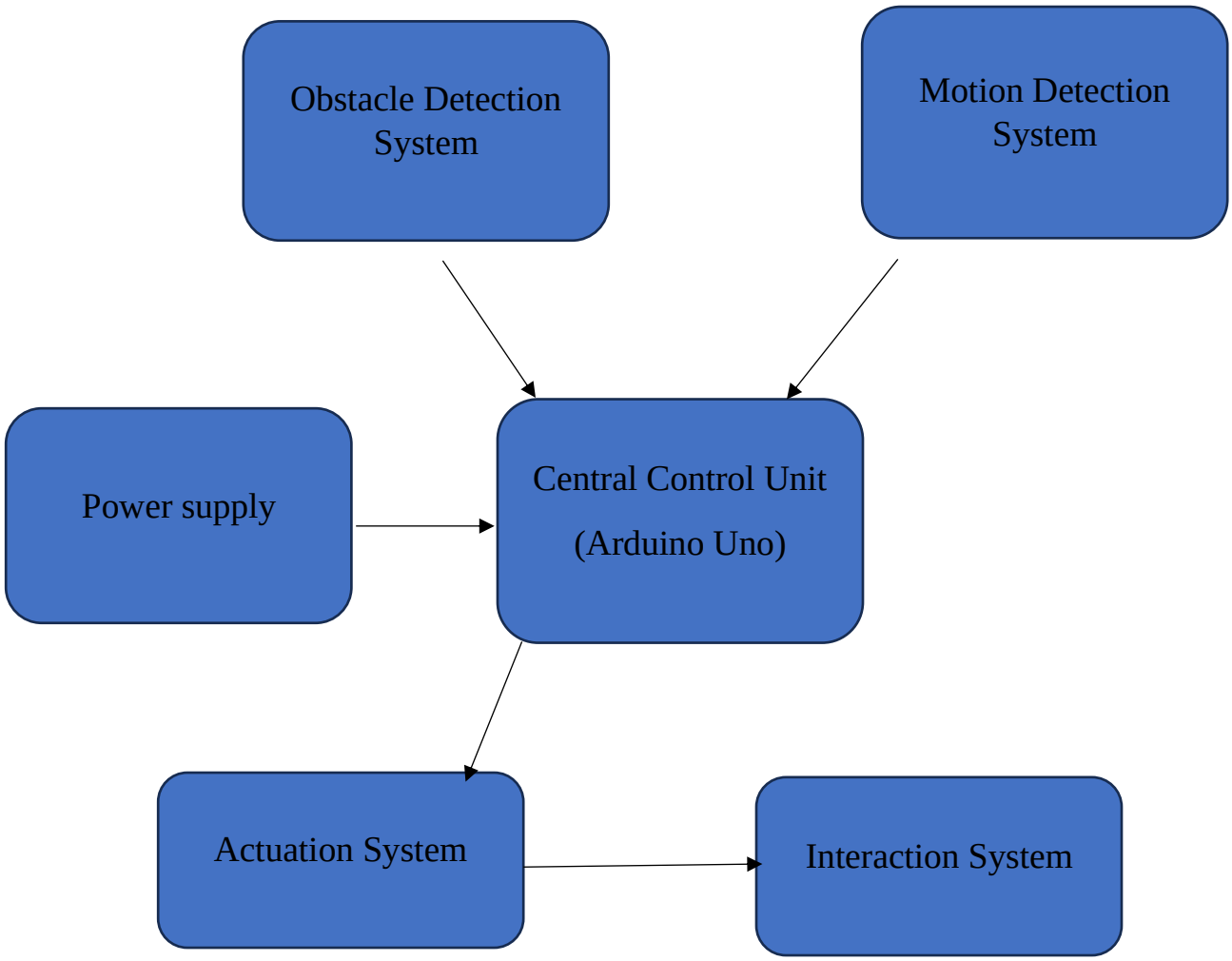
The navigation system and interruption response are the main areas of improvement for this prototype. It is currently made for flat, basic interior venues like event halls or offices, but upgrades for more complicated settings are in the works.

2. Specifications

1. Autonomous Navigation: Moves independently in a straight line, adjusting its direction when obstacles are detected.
2. Obstacle Avoidance: Detects and navigates around obstacles to ensure uninterrupted movement.
3. Interrupt-Based Interaction: Responds to motion of human’s by pausing its navigation workflow.
4. Human Interaction Mode: Stops near individuals in the ISR flow for a brief period to allow interaction.
5. Workflow Resumption: Returns to its original navigation routine after interactions.

3. Implemented Solution

Block Diagram and Description



4. Description of each block

Central Control Unit

Figure 3.1:Arduino UNO

The robot's brain, the Central Control Unit (Arduino Uno), controls all inputs and outputs. It makes judgements for navigation and interaction in real time by analysing input from the motion and obstacle detection systems. Additionally, it manages interruptions, making sure the robot pauses and restarts its task when necessary. This component manages the actuation system, guiding motion and interactions while ensuring seamless functioning.

Obstacle Detection System

Figure 3.2:HC-SR04 Sensor

By detecting obstacles in the robot's route, the Obstacle Detection System aids in safe navigation. It communicates this information to the Central Control Unit by using sensors to determine the distance to adjacent obstructions. The robot uses this information to modify its motion in order to prevent collisions and carry on with its voyage without incident.

Motion Detection System

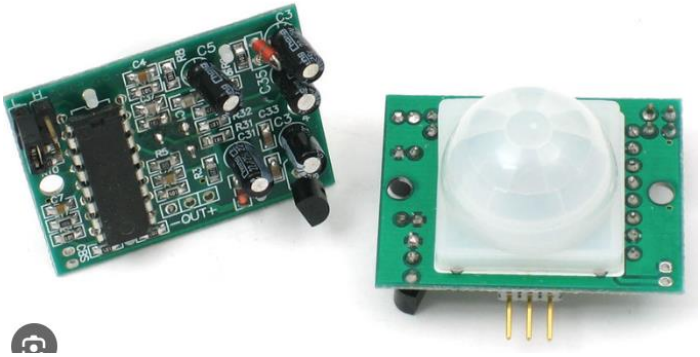


Figure 3.3:PIR sensor HC-SR501

When someone is close by, the Motion Detection System detects it. The robot's movement is momentarily stopped when motion is detected because the Central Control Unit receives a signal from it. This gives the robot time to engage before it starts navigating again.

Actuation System

Figure 3.4:L298N DC Motor Driver Module

By moving the wheels forward, backward, or changing the robot's direction, the Actuation System regulates its motion. Using motion and obstacle detection inputs, it ensures smooth navigation by obeying directions from the Central Control Unit.

Interaction System

When the robot detects motion, the Interaction System enables a brief pause for user interaction. It makes sure the robot remains still for a brief amount of time so that users can engage with it. The Central Control Unit is alerted to resume regular operations and navigation after the predetermined amount of time.

Power System

Figure 3.5:Energy Supliers

The Power System supplies energy to all components of the robot, ensuring stable and efficient performance. A 9V battery powers the Arduino Uno, while a 12V battery is used for the motors, providing the necessary power for smooth movement and reliable operation.

5. Model solution (simulation)

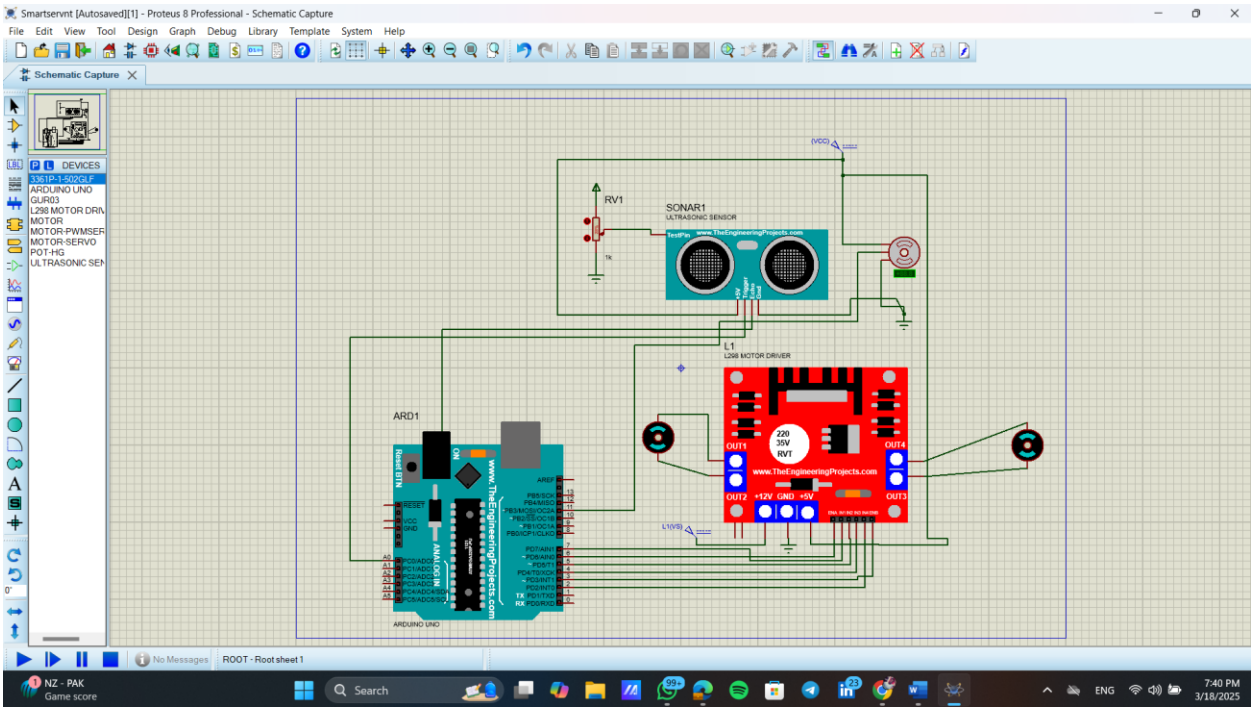


Figure 3.6:simulation of the robot

6. flow chart of the firmware

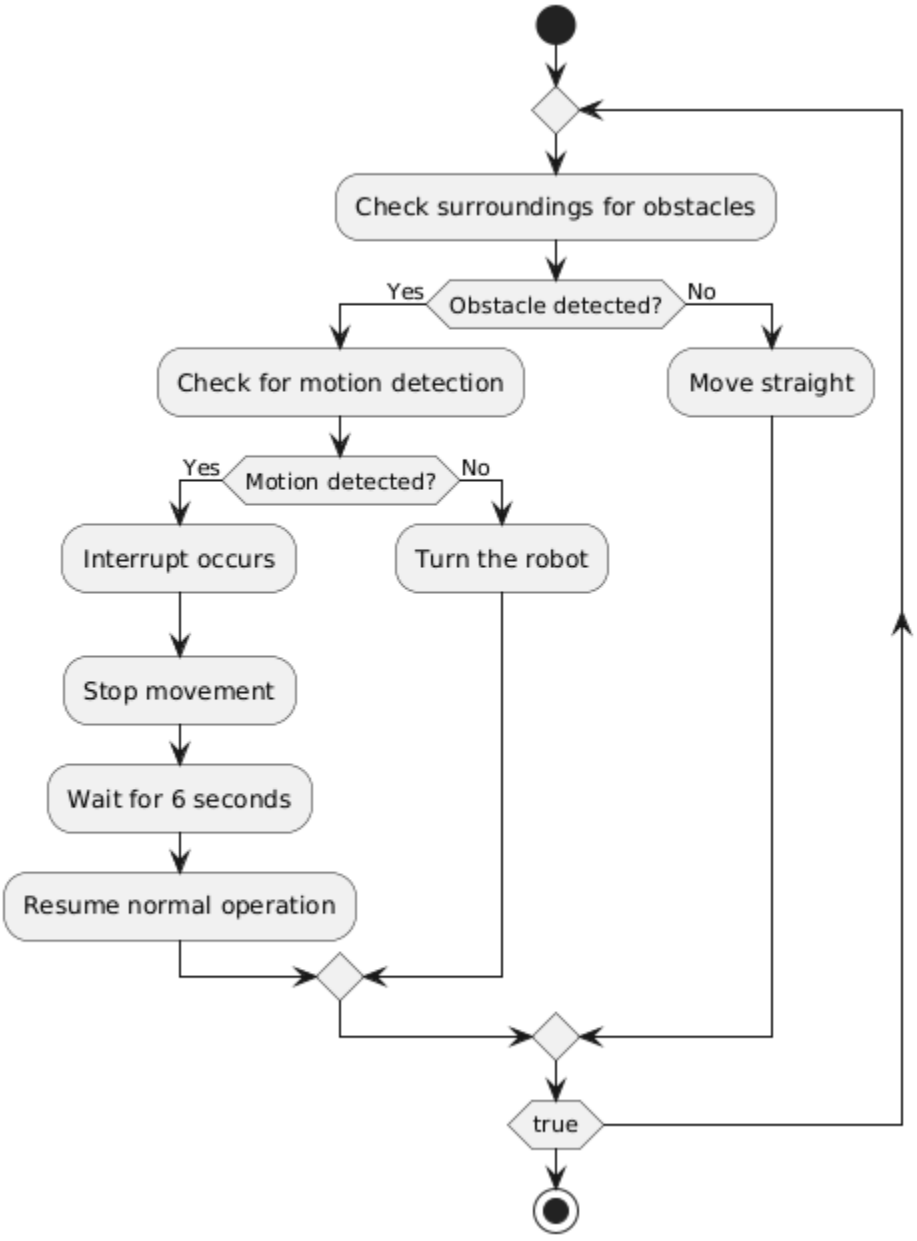


Figure 3.7:Flow Chart of the Robot

7. Images of the final product.

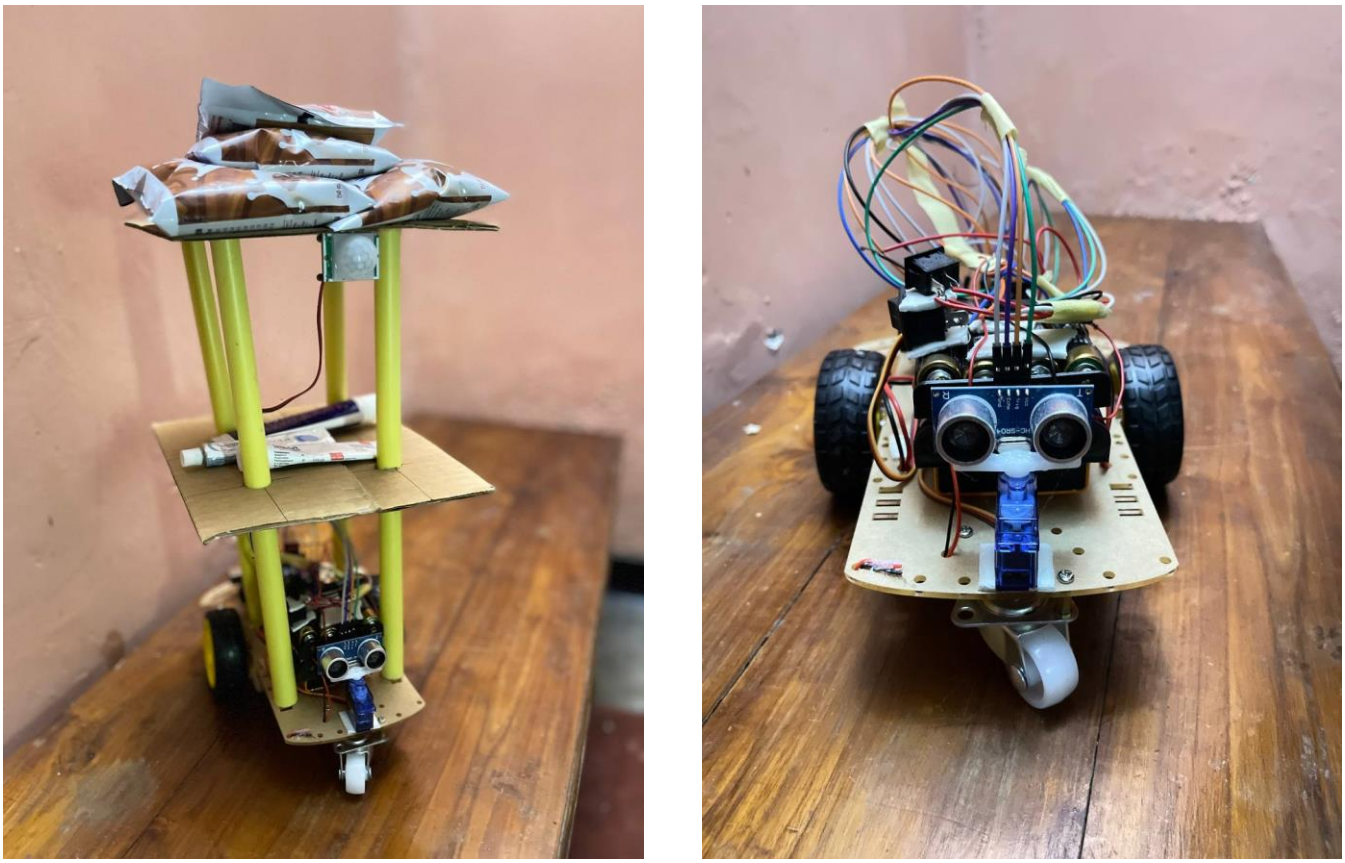


Figure 3.8:Final images

8. References

https://docs.arduino.cc/hardware/uno-rev3/

https://circuitdigest.com/microcontroller-projects/obstacle-avoiding-robot-using-arduino-and-servo-motor

https://smartservant.nl/service-robots/

https://www.youtube.com/watch?v=oSLUJDV17XA&t=6s