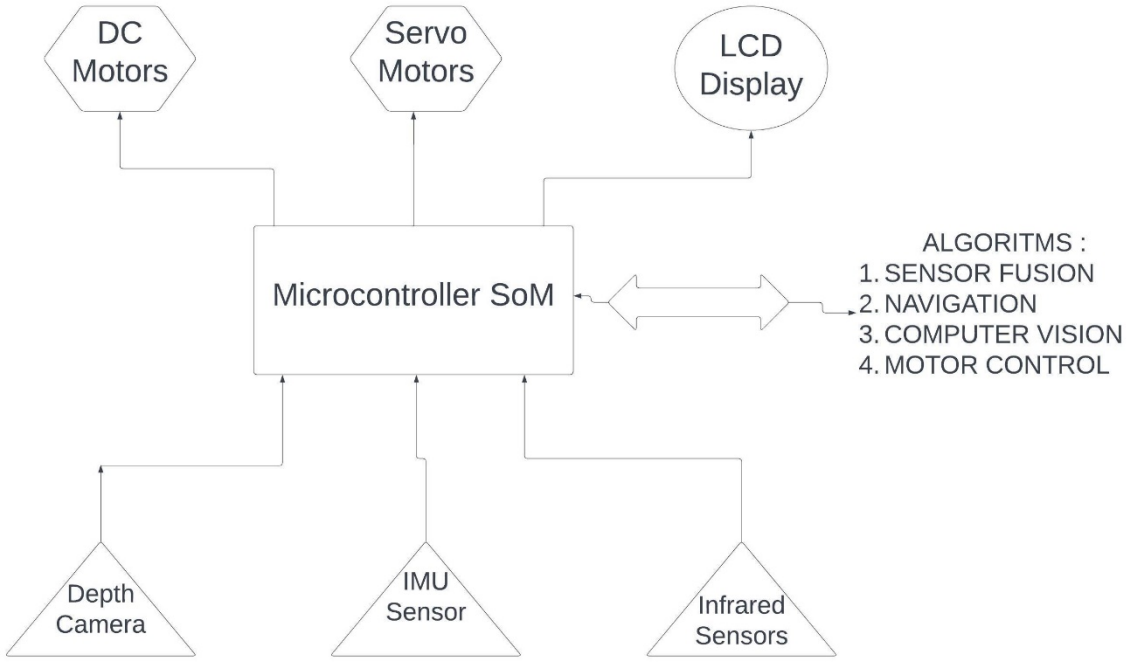
COOKING ROBOT



BLOCK DIAGRAM OF COOKING ROBOT

The goal is to design a robot that can assist with pre-cooking tasks like washing, chopping, etc. which take up a significant amount of time in the overall cooking process.

Possible uses of this robot are:

- To help people with restricted movement, like the elderly or individuals with disabilities, with cooking.
- In restaurants, so that chefs can focus on the main cooking process.
- It can be deployed in hospitals and healthcare facilities to assist with food preparation for patients so that the specific dietary requirements of the patients can be met.

POWER

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Component	Power Consumption	Estimated Total Price
DC Motors (x4)	100 W	$140
Depth Camera	5 W	$200
LCD Display	1 W	$50
Infrared Sensors (x2)	0.2 W	$30
Microcontroller System on Module	36 W	$350
IMU Sensor	0.5 W	$70
Servo Motors (x6)	216 W	$270
Lithium Polymer Battery	-	$1500
TOTAL	358.7 W	$2610

Note: The no. of motors and sensors is just a rough estimate. This can change as per the actual design of the robot. The same is applicable for the cost of all the components.

A 12V Lithium-Polymer battery is used for this robot, which shall be suitable for 8 hours of operation time.

Battery Capacity Calculations:

Power Required = Total Power Consumption * 1.2 (Considering 20% Margin on Power)

= 358.7*1.2 = 430.44 W

Battery Capacity = Power Required * Time

= 430.44 W * 8 h = 3443.52 Wh

A standard Battery Capacity of 3600 Wh is available in the market. We will use this for our application.

LCD Display: For user interaction. This user can select a recipe, according to which the robot can carry out the required tasks. Customizable recipes can be created as well.

DC Motors: These motors will be used for the movement of the robot around the kitchen.

Servo Motors: These motors will be used to control the arm movements of the robot for different tasks.

NAVIGATION

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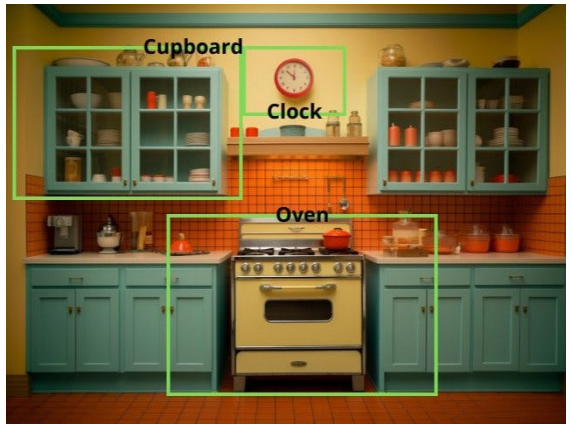
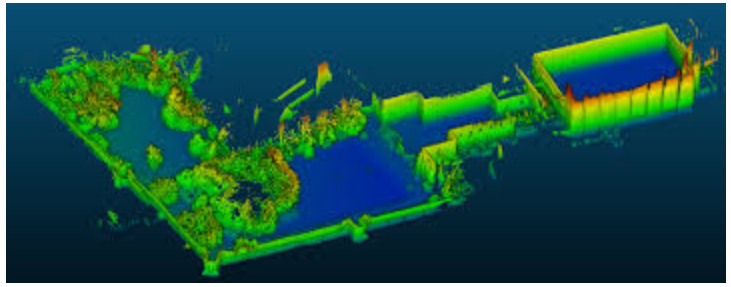
Object Recognition

The Depth camera will be used for object recognition as well as 3D mapping of the environment. It will be used as an input for the SLAM algorithm to map the kitchen space. Object recognition is important so that it can carry out tasks with utmost safety and move around humans or other moving objects with ease, i.e., obstacle avoidance.



Simultaneous Localization and Mapping

For mapping the environment, the SLAM algorithm will be combined with the Inertial Measurement Unit (IMU) sensor. An Indoor Positioning system will be used since the robot is built for indoor applications. Path planning can be executed with this as the robot navigates around the kitchen.



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SENSORS

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Depth Camera

A Depth camera is used here to grasp objects like knives, whisks, vessels, etc.

It will also be used for localization and mapping.

IMU Sensor

This sensor will be used to measure the orientation and help in motion control for accurate and smooth movement of the robot.

Infrared Sensors

Infrared Sensor is used for object detection to avoid collisions and retrieve objects.

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SOFTWARE/HARDWARE

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Software

Robot Operating System (ROS): It will be used to implement the Sensor Fusion algorithm for IMU and Depth camera so that we can use it for SLAM.

Python: It will be used for implementing all the navigation, image processing and motor control algorithms for this robot.

Computer Vision: The OpenCV library in Python will be used for object recognition and camera calibration.

Hardware

The microcontroller required for this robot will be a system-on-module (SOM) board with real-time processing capabilities that has the following components:

- Raspberry Pi Microcontroller
- Fan and Heat Sink
- Display Port
- Ethernet Port