

Raspberry pi based Surveillance Robot for Real Time Intrusion Detection and Tracking

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Problem Statement

Make a surveillance robot to ensure safety of the house, identify the intruder, track him and alert the owner.



Motivation

With increase in workforce of the country, the houses remain vacant when it's members are out there in offices. Hence there is :

- Need to ensure security of house.
- Need of an assistant in house.
- Need to alert owner if someone unwanted comes in.

We aim to build a surveillance robot that solves the above needs.



Objective

Once completed the robot will solve the following requirements:

- Identify the person as known or unknown, when the person enters.
- Alert the owner if the person is unknown, send an image of intruder to the owner.
- Follow the intruder and send his actions to owner.
- Take next set of instruction from owner and work accordingly.
- Return to its original position.

Idea Matrix



Scoring 1 = Low 2 = Moderate 3 = High	Different or Better	Delivers Value	Doable, Practical	Potential for early adopters	Score
Person Identification, Communication & Tracking Robot	H	M	H	H	11
Domestic Help Robot	M	H	L	M	8
Home Automation Robot	L	H	M	H	9



Hardware Requirements

- Raspberry Pi 3B
- Ultrasonic Sensor Module HC-SR04
- ROBOT Chassis
- Wheels, DC Motors
- Raspberry pi 5MP camera
- Bread Board
- Resistor (1k)
- Motor Driver L298 2A
- Connecting wires
- Power supply or Power bank



Software Requirements

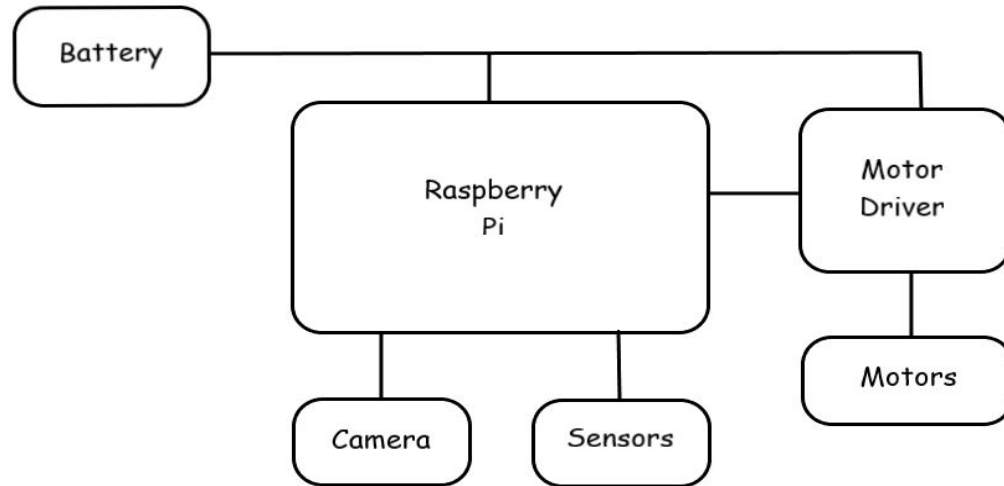
- Python3 and necessary libraries.
- Text Editor
- Raspberry pi OS
- VnC Server
- Telegram app

Literature Survey



Title	Published Year	Basic Idea
Human Detection and Tracking for Video Surveillance: A Cognitive Science Approach	2017	<ul style="list-style-type: none">● Detect human beings in any frame.● Find the movement patterns of the humans in the frame.
Obstacle Detection and Avoidance Robot	2018	<ul style="list-style-type: none">● Detect and avoid any obstacles in the path.● Focuses on the edge detection for higher accuracy.
Design and Implementation of an Autonomous Indoor Surveillance Robot based on Raspberry Pi	2019	<ul style="list-style-type: none">● Identify the person and alert the owner.● Take necessary actions through the commands given by the owner.

System Architecture





Single Shot Detection Algorithm

Single Shot detector takes only one **shot** to **detect** multiple objects present in an image using multibox. It is significantly faster in speed and high-accuracy object **detection** algorithm.

SSD divides the image using a grid and have each grid cell be responsible for detecting objects in that region of the image. **Detection** objects simply means predicting the class and location of an object within that region.

Local Binary Pattern

Local Binary Pattern (LBP) is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number.

The algorithm uses a concept of a sliding window, based on the parameters radius and neighbors.

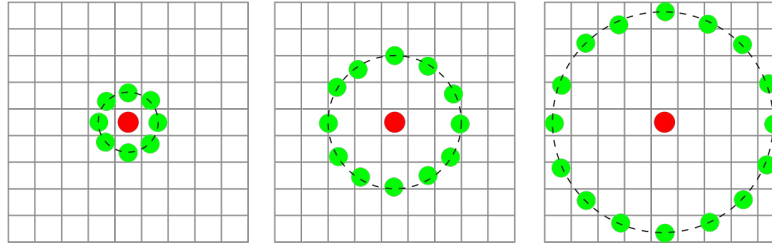


Figure: Three neighborhood examples used to define a texture and calculate a local binary pattern (LBP).

Frontend Images





Conclusion

Even though the development cost is kept as low as possible, the system is capable of navigating autonomously while engaged in surveillance, recognizing intruders via facial recognition.