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A Review Paper on Autonomous Robotics: Sensors and Vision

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ABSTRACT: In present how robots play their role for linked the humans and animals respond to environment. In this review paper discuss about the sensors, algorithms and actuators how the works together in the interaction and autonomous tasks in the world. Sensors means clear that sense the organs, it captures the data and provide information for make decision algorithms.

Algorithms are that which is used for the intelligence of autonomous vehicles. Its discussion algorithm navigates the robots and function autonomously. Actuator which is muscles of the robot or physical body which interact with surrounding.

KEYWORDS : Introduction, robotics, artificial intelligence, computer vision, sensor fusion, robotic autonomy levels, conclusion.

INTRODUCTION

In the today's world we use to the word robots so what are robots. These are machines like human being and that are replicate some human movements there are various types of robots but we are going to review about autonomous robots. So, what are the autonomous robots these are the robots which work with the help of artificial intelligence and machine learning these robots are almost human beings in some places. In the landscape of autonomous robotics, the fusion of sensors and vision stands as a linchpin, navigate, and interact with their surroundings. The symbiotic relationship between sensor technologies and vision capabilities has led to remarkable strides in the development of robots.

Sensors serve as the sensory organs for autonomous robots, offering a myriad of data inputs that range from capturing visual information through cameras to sensing depth and distances via LIDAR (Light Detection and Ranging).

By examining the amalgamation of sensors and vision in autonomous robotics, this overview endeavors to provide an understanding of the pivotal role these technologies play in shaping the capabilities and limitations of autonomous robots. Ultimately, it aims to contribute to the ongoing discourse and advancement in the field, steering the focus towards creating robots endowed with sharper, more insightful, and visual capabilities.

ARTIFICIAL INTELLIGENCE: Artificial intelligence refers to the simulation of human intelligence in machines that are programmed to think, learn, and perform tasks typically requiring human intelligence. These tasks include problem-solving, understanding natural language, recognizing patterns, learning from experience, and making decisions.

It can be defined by two types:

1. Narrow or weak ai
2. General or strong ai

Use in autonomous robots: It is prime application of artificial intelligence with the use of sensors, decision making, path planning, task execution and self-improvement. Let us understand each and every area of artificial intelligence in autonomous robots. The first thing to know about the thinking that how an artificial

intelligence thinks and how it works, there are very algorithms that help in natural language processing and understand the other movements through the help of sensors and then get that information to the neural networks of artificial intelligence.

SENSORS:

The aim of the control system is to provide a robot system with autonomous capabilities. An off-line programming and simulation environment is needed to create the off-line program. The correctness and functionality of this program can be tested and adapted in simulation. The simulation environment should be transparent to the available robot hardware.

In the first place the control system must be capable of detecting deviations of environment variable values from their expected value. This monitoring activity is performed in parallel to the execution of the off-line program. The sensor system is thus used both for the realization of pre-planned closed control loops and for detecting the occurrence of exceptions.

For sense anything by the robots they require the algorithms and sensors that help them in understand what they need to do in the world according to their sensors.

The sensors are used in autonomous robotics are:

1. Lidar
2. Radar
3. Ultrasonic
4. Camera
5. GPS

Sensors are that which help in remove the or sense the obstacles coming in the path of the robots , the flow chart that explain how robots senses the obstacles in their path : in the fig.we can see that there are components or stages named , infrared dectection, data computation, following the targeted person, and then if there is any obstacle then the algorithms are used in order to avoid the obstacle and if there is not any obstacle then it will continue to work with and then the goal of that robot is achieved.

This is how a robot.

Robot = artificial intelligence + sensors + algorithms

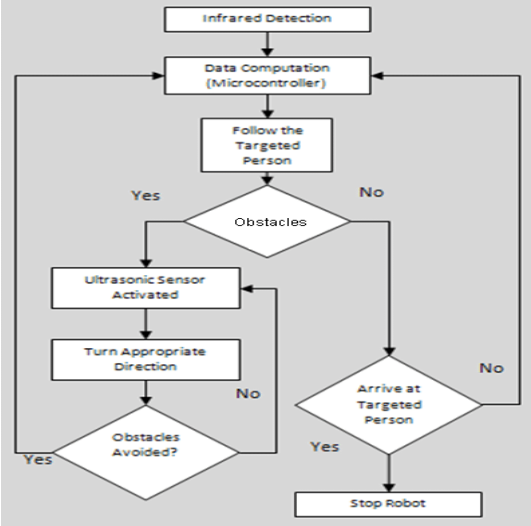
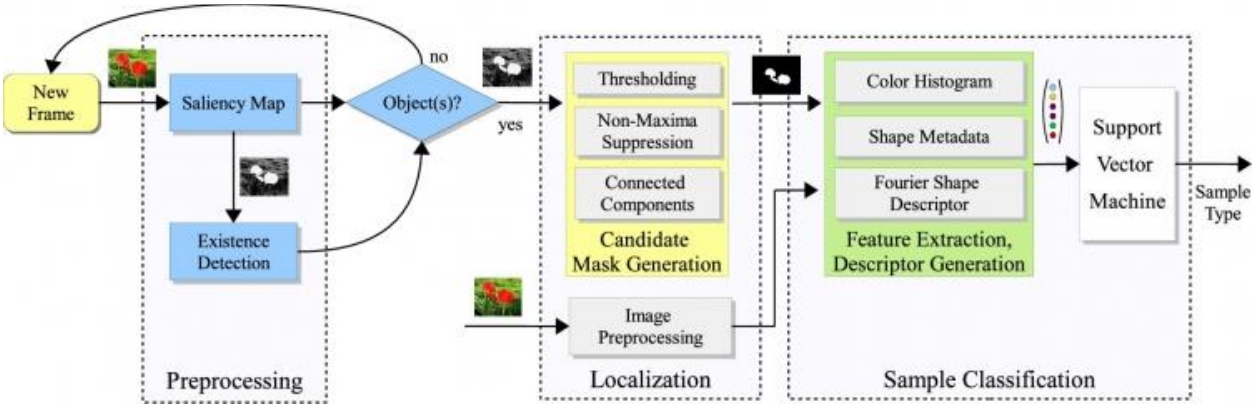


Fig.(a) flowchart of robot working

Computer vision in autonomous robots: As we know the robots work with the sensors and that sensors examine the obstacle or detect the obstacle now the real game played by the computer vision which detect the whole environment with the help of sensors.



Overall three-stage classifier cascade framework for sample detection and classification

So, the computer vision plays a crucial role in examination of environment so that the robots can easily aware of environment and take appropriate actions. Here are several ways computer vision is integral to autonomous robots:

1. **Object Detection and Recognition:** Robots need to detect and recognize objects in their environment to navigate and interact effectively. Computer vision algorithms can identify and categorize various objects, such as pedestrians, vehicles, obstacles, traffic signs, and more.
2. **Localization and Mapping (SLAM):** Simultaneous Localization and Mapping (SLAM) is a vital technique for autonomous robots to create maps of their environment while simultaneously determining their own position within it. Computer vision helps in creating these maps by analyzing visual data and identifying landmarks or features for navigation.
3. **Obstacle Avoidance:** By using computer vision, robots can detect and avoid obstacles in their path. This is essential for safe navigation, especially in dynamic and unpredictable environments.
4. **Semantic Segmentation:** It involves identifying and segmenting different areas or objects within an image. This information is valuable for robots to understand their surroundings more precisely, enabling them to make better decisions and navigate more effectively.
5. **Scene Understanding and Interpretation:** Computer vision helps in understanding the context of a scene, enabling the robot to comprehend complex scenarios, like interpreting traffic conditions, understanding road signs, or identifying different types of terrains.
6. **Gesture and Emotion Recognition:** Some autonomous robots are designed for social interaction or assistance. Computer vision allows them to recognize gestures, facial expressions, and emotions, enabling more natural and effective human-robot interaction.
7. **Enhanced Decision Making:** By providing a comprehensive view of the surroundings, computer vision equips autonomous robots to make informed decisions in real-time, such as adjusting their path, speed, or actions based on what they perceive.
8. **Deep Learning and Neural Networks:** Advanced techniques in deep learning, particularly convolutional neural networks (CNNs), have significantly improved the accuracy and efficiency of computer vision tasks for autonomous robots, allowing for more robust and reliable perception systems.

CONCLUSION

We have reviewed about the autonomous robots that how they work and how they detect their environment. In the conclusion, we can overall define that autonomous robots are the collection of computer vision, algorithms in artificial intelligence and sensors. The computer vision used to identify the environment in which the robots are working. The sensors are used for their perspective work like temperature sensors tells about the temperature in the atmosphere and so on. Artificial intelligence used to work with neural networks so that your humanoid robot can think like a human so that the autonomous robots can handle every problem for which they are made.

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