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OPTIMIZATION OF REMOTE CONTROL OF MEASUREMENT RESULTS THROUGH A MANIPULATOR

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Abstract

It is aimed at optimizing remote control of manipulators based on measurement results in automated systems. As the use of robotic systems in various industries is increasing, precise control of robotic manipulators is essential to achieve high precision and efficiency. Learns how to use optimization algorithms such as Gradient Descent, Genetic Algorithms, and Kalman Filtering to adjust manipulator movements based on feedback from measurement systems.

Keywords: Manipulator, Measurement Systems, Remote Control, Optimization, Stochastic Optimization, Gradient Descent, Genetic Algorithms, Model-Based Control, Measurement Errors, Robot Control.

Introduction

The issue of optimization of remote control by manipulator of measurement results is mainly aimed at controlling measurement systems, improving their accuracy and ensuring efficient execution of operations. This issue is often related to industrial robotics, automated systems, remote control systems, and measurement techniques. These types of systems require optimized control to not only get measurements right, but also to use them as efficiently as possible.

In such systems it is necessary to establish remote control, establish the interaction between the manipulators and measuring systems, correctly control the measurement results by the actions of the manipulators and to implement targeted optimization.

Understand the relationship between measurement results and manipulators

The manipulators work in the same way that they are integrated with metering systems. Metering systems allow monitoring of the manipulator's condition, position, and movement in real time. In this case, the manipulators are controlled by remote control systems, and the measurement results are used to control the manipulators in an optimized manner. Remote control and optimization. The goal of remote-control optimization is to make system operation more efficient, maximize the utilization of measurement results, and speed up the processing of results. At the same time, the following elements are mainly taken into account:

Control Algorithms: Efficient control algorithms are used to properly manage measurement results and optimize manipulators.

For example, using PID control systems (Proportional-Integral-Derivative), fuzzy logic or closed-loop control systems, the actions of the manipulator and the measurement results are analyzed. Mathematical modeling: The interaction between measurement systems and manipulators is illustrated through mathematical models. These models help to consider, for example, kinematic and dynamic properties of manipulators, uncertainty and errors of measurement systems. The application of inverse kinematics and kinematic planning models plays an important role in optimizing the position and position of the manipulator. Optimization by measurement results**:** The data obtained through measurement systems is used to control the position, movement and operations of the manipulator. Optimization techniques (e.g., gradient descent, genetic algorithms, optimization with simulations) are used in the questions of meter-based manipulation and motion optimization. Integration of remote-control systems and dimensions. Integration between the remote-control systems and the measurement results improves the operational efficiency of the system. To properly set and optimize the operation of the remote manipulator, the following important points are considered:

Real-time monitoring and analysis**:** Measurement systems are essential for monitoring and controlling the movement of the manipulator in real time. This is done, for example, by using sensors (position, force, pressure, temperature, etc.). By optimizing the interaction between the measurement system and the movement of the manipulator, the reliability of the system is enhanced. Calculation and compensation of errors. Remote control systems must provide fault compensation. Taking into account errors and inaccuracies of measurement systems, the control system automatically corrects the behavior of the manipulator.

Example: Optimizing a manipulator using Python and ROS

Using the Python programming language and **ROS (Robot Operating System)** to control the manipulator and optimize the measurement results, the following steps can be performed:

1. Taking measurements from sensors (e.g., laser sensors, cameras, GPS).
2. Control the robot's movement and position via ROS to control the manipulator.
3. Use optimization algorithms, such as gradient descent**,** Genetic algorithms, or Kalman filtering to minimize errors.

Example code (Python and ROS):

```
import rospy
from geometry_msgs.msg import Pose
from sensor_msgs.msg import LaserScan

def optimize_manipulator_move(sensor_data):
   # Optimization of manipulator movement based on data from sensors
   # Special optimization algorithms (eg, gradient descent) can be used here
   optimized_move = some_optimization_algorithm(sensor_data)
   return optimized_move

def sensor_callback(msg):
   sensor_data=msg.ranges# Data from laser sensor
   optimized_move = optimize_manipulator_move(sensor_data)
   move_manipulator(optimized_move)

def move_manipulator(move):
```


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```
    # Manipulator control
    manipulator_cmd = Pose()
    manipulator_cmd.position.x = move[0]
    manipulator_cmd.position.y = move[1]
    manipulator_cmd.position.z = move[2]
    manipulator_pub.publish(manipulator_cmd)

rospy.init_node('manipulator_optimizer')
manipulator_pub = rospy. Publisher('/manipulator/command', Pose, queue_size=10)
sensor_sub = rospy. Subscriber('/laser_scan', LaserScan, sensor_callback)
rospy.spin()
```

Conclusion

Optimization of the remote control of measurement results through a manipulator means the management of the data from the measurement systems and ensuring that the movements of the manipulator are optimally implemented. This issue requires the application of mathematical modeling, control algorithms, and optimization techniques. At the same time, the manipulator is allowed to move through the above application code.

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