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Development of a multi-agent architecture for an object shape recognition system based on data from a depth sensor.

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SUMMARY

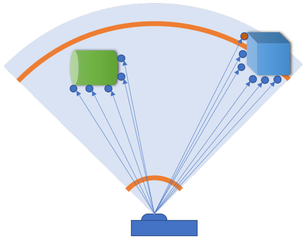
The concept of an object shape recognition system for an autonomous robot based on a multi-agent neurocognitive architecture. The Microsoft Kinect controller is considered as an example of a depth sensor. The algorithm of the program for preprocessing data from the depth sensor and the multiagent neurocognitive architecture responsible for building a model of the surrounding space, where each object is associated with a certain cloud of three-dimensional points, are presented. The proposed data processing system can be used as an element of the navigation and orientation system for autonomous mobile robots used in a real environment.

INTRODUCTION

Depth sensors (Microsoft Kinect) can be used to build model of the external environment. This controller consists of a set of sensors: an RGB camera, a depth sensor, an array of microphones. At the same time, of interest is the system for processing data obtained from such depth sensors, which from a cloud of points will make it possible to obtain three-dimensional models of objects of the real environment. Multiagent neurocognitive architectures that are functionally similar to the brain are one of the approaches to designing decision-making systems for autonomous mobile robots. The development of an algorithm for processing data from a depth sensor based on such architectures will solve a number of problems associated with the difficulties of orienting autonomous robots in real environment.

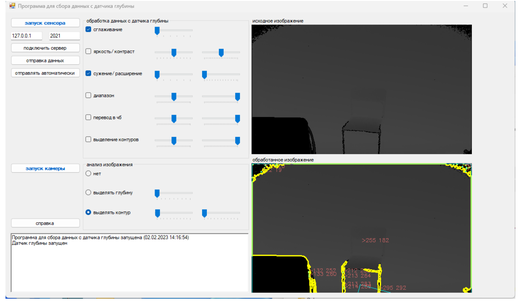
DEPTH SENSOR SOFTWARE PROCESSING

To implement the robot navigation system, it is necessary to provide point cloud clustering and 3D object extraction. For this purpose, which the distance to neighboring points is calculated for each point. If the distance is below the threshold, the point is included in the cluster. Otherwise, all points are sent to the decision system.



Depth sensor operation diagram

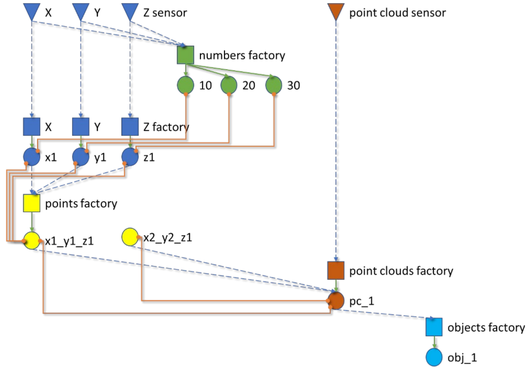
A program that allows offline capturing frames from the sensor, pre-processing them and sending the received data to the decision-making system of an autonomous robot was developed to ensure the collection and processing of data from the depth sensor.



Program for pre-processing data from the depth sensor screenshot

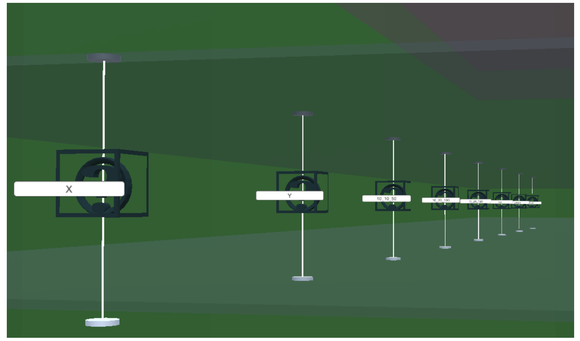
MULTI-AGENT DEPTH SENSOR ALGORITHM

After preprocessing the resulting point cloud, it is necessary to ensure the transfer of the received data for further processing to the multiagent neurocognitive architecture. Further data analysis is performed using the developed multi-agent architecture for building a point cloud and a model of three-dimensional objects based on data from a depth sensor. At the moment of receiving a signal from the depth sensor, a set of point clouds is sent to the decision-making system core in the form of an array of X, Y and Z coordinates and the number of the point cloud. All data gets to the corresponding sensors of the multi-agent architecture, sent to the "factories" of points and point clouds. Separately, work is underway to process other modalities of the sensory stream, which provide recognition of objects and their features. When an object is recognized, a separate actor is created that enters into multi-agent contracts with their associated point clouds. and then



Multi-agent depth sensor data processing algorithm

SCREENSHOT



Screenshot of the presented algorithm created in the multi-agent architecture editor

CONCLUSIONS

A pre-processing program and a multi-agent architecture of an object shape recognition system based on data from a depth sensor have been developed to perform the task of navigating and orienting an autonomous robot. The developed program allows you to get a depth map and a map of the contours of areas with the same distance from the sensor. In addition, a multi-agent neurocognitive architecture for processing data from a depth sensor is described, which will allow building a representation of the shape and location of each object in a real environment. The use of a depth sensor with data post-processing will make it possible to develop more efficient methods for navigating and orienting autonomous robots in a dynamically changing partially observed external environment.