MTRX2700

Estimative Shape Capture and Perception Equipment

User Manual

Group 8

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1 Overview

This document details solely the essential instructions and knowledge necessary for a user to operate the Object Detection and Area Evaluation System. For a in-depth description of the user interface and the system modes of operation, refer to the project report. The system utilises various sensors and actuators to map out an object within a specified field of view and evaluates the surface area of the object through algorithms implemented in the software. The user can interface with the system through two options: the Dragon 12 HCS12 board, or the PC interface built in MATLAB through a serial connection to the microcontroller.

2 Interface Summary

The interface is quite intuitive and simple. In board mode, when a selection is available to the user, it will be displayed on the LCD screen in the format "1-Option", where that option corresponds to a '1' character press on the board keypad. In PC mode, an equivalent message is displayed in the MATLAB command window. For numerical input (such as resolution, samples, scan delay etc.) in board mode, a command prompt ">>" appears on the second row of the LCD display, and the user can use the keypad buttons to enter input. If the value supports float inputs, the asterisk ('*') character key corresponds to the decimal point character. Additionally, the 'C' button is used as a backspace key and the 'D' key is used as the Enter key to confirm the inputted value. In PC mode, the MATLAB interface will display the command prompt ">>>" when waiting for input.

3 Interface Selection

3.1 Board Mode Operation

Operation of the program in Board mode disables the serial communication interface, allowing only user input from the 16-button keypad located near the bottom right of the microcontroller board, and printing user output to the LCD display towards the top right of the board. To initialise the program in Board mode, run the program then press any keypad button upon seeing the "Press key on Board or PC" message.

3.2 PC Mode Operation

Operation of the program in PC mode disables the keypad input from the HCS12 board, only allowing user input through the serial interface from the PC. To initialise the program in PC mode, run the program on the board and run the MATLAB interface program on the PC and press the Enter key in the MATLAB command window to send a connection request. If the connection is accepted by the board, the program will proceed.

4 Mode Selection

Once the program has entered Board or PC mode, the next input will request the user for scan or test mode. Enter '1' for Scan mode, or '2' for test mode. Scanning mode is the main program function to perform scans of an object. Testing mode is used to verify the individual function of each sensor/actuator of the system.

5 Scanning Mode

Before a scan is executed, the user must specify the settings of the scan. These settings are outlined below.

5.1 Resolution

This is the step size of the scan in degrees. This value is a float and the valid range is between 0.1 and 20. Using a small step size will greatly increase the scanning time.

5.2 Samples

This value is the samples taken at every point in the scan. The median of the samples is taken as the measurement. Using a higher number of samples will generally increase the accuracy of the scan and reduce noise. This number is an integer and the valid range is between 1 and 200.

5.3 Scan Delay

This is the delay in milliseconds between each scan point. In the testing conducted, there were no benefits to introducing a delay. Therefore for optimal performance, a zero delay should be selected. This value is an integer with a valid range between 0 and 10000.

6 Testing Mode

In testing mode, there are five options corresponding to the 5 sensors/actuators. These options are detailed below.

6.1 Servo Motor Test

In the testing mode of the servos, the user can enter an angle to move either of the servo motors. In board mode, the 'A' and 'D' characters are used as the Enter keys. The 'A' key is used to enter the pan angle, while the 'D' key is used to enter the tilt angle. In PC mode, an angle followed by the letter 'p' for pan or 't' for tilt will move the servos instead (e.g. "90p"). The angle value is a float with a valid range between 0 and 180.

6.2 LIDAR Test

In LIDAR test mode, the number of samples per point is first requested as user input. After the number of samples has been specified, the LIDAR will start taking readings and outputting the distance in millimetres on to the LCD and 7-segment displays.

6.3 Gyroscope Test

In gyroscope test mode, the pan and tilt angle as determined by the gyroscope is displayed on the LCD display.

6.4 Magnetometer Test

In magnetometer test mode, the pan as determined by the magnetometer is displayed on the LCD display.

6.5 Accelerometer Test

In accelerometer test mode, the tile as determined by the accelerometer is displayed on the LCD display.