MTRN4230: ROBOTICS

Assignment 2

Communication Protocol

and Testing

Group 6

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COMMUNICATION PROTOCOL

While communicating between MATLAB and RobotStudio all messages started with a eight character word which was used to trigger the respective case statement in RobotStudio. Additionally, if required, extra numerical values preceded the first eight characters to provide information such as coordinates, enable/disable, etc. Below are the

DIO Set Commands

Vacuum Control:

> "VACUUMON" and "VACUUMOF" : Triggers the case statement to enable and disable the Vacuum functionality respectively.

> "SETSOLEN, 0/1" : Used to toggle the status of the Vacuum pump where 1 turns on the pump and 0 turns it off.

Conveyor Control:

> "CONVEYON" and "CONVEYOF" : To turn on and off the movement of the conveyor belt, respectively.

> "CONVDIRE, 0/1": Sets the direction of the conveyor belt where 0 is away from the robot and 1 is towards.

Motion Set Commands

"MVPOSTAB, X,Y, Z": Moves the End effector to the inputted X,Y and Z positions which are assumed to be relative to the table.

"MVPOSCON, X,Y, Z": Moves the End effector to the inputted X,Y and Z positions which are assumed to be relative to the conveyor.

"SETSPEED, vspeed" : sets the speed of the robot to the value in mm/s. Possible values: v10(fine), v50(slow), v100(medium), v200(fast)

"SETPOSES, q1,q2,q3,q4,q5,q6": moves the robot by moving each joint angle to the respective inputted angle. Possible Values: q1: -165 to 165, q2: -110 to 110, q3: -110 to 70, q4: -160 to 160, q5: -120 to 120, q6: -400 to 400.

"JOGJOINT,num,pos/neg" : rotates the Joint respective to the joint number given by "num" and moves it in the counter clockwise direction if given the input "pos" else clockwise if given "neg". This is done for one increment based, hence the angle rotated by is based, on the current speed of the robot.

"EEORIENT qaut1, quat2,quat3,quat4" : Reorients the end effector using the given values of each quaternion.

"LINMDBAS, X/Y/Z, pos/neg ": Uses linear movement to move the end effector to the inputted X, Y or Z values, in the positive or negative direction based on "pos" and "neg". This is done for one increment based, hence the distance moved is based, on the current speed of the robot.

"ROBPAUSE": Pauses the current motion task

"ROBRESME" : Resumes previous motion task

"ROBCANCL": Cancels previous motion task

Status Read Commands
Robot Status:

"JNTANGLE" : Sends joint angles to MATLAB

"EEPOSITN": Sends end effector position to MATLAB

"EEORIENT": Sends end effector orientation to MATLAB

"INMOTION": Sends inMotion status

I/O Status:
"GTCONSTA" : Sends ConStat status

"GTVACRUN" : Sends VacRun status

"GTVACSOL" : Sends VacSol status

"GTCONRUN" : Sends ConRun status

"GTCONDIR" : Sends ConDir status

"GTMOTRON" : Sends MOTOR_ON status

"GTESTOP1" : Sends ESTOP status

"GTESTOP2" : Sends ESTOP2 status

"GTEXCERR" : Sends EXEC_ERR status

"GTHDENBL" : Sends HOLD_TO_ENABLE status

"GTLTCURT" : Sends LIGHT_CURTAIN status

"GTMOTSUP" : Sends MOTION_SUP_TRIG status

"GTMOTONS" : Sends MOTOR_ON_STATE status

"GTTROBRN" : Sends TROB_RUNNING status

Error:
If error happens while moving the robot the "errmsg" interrupt sends the message "Robot Movement Limit" else the message "Movement Okay" is returned.

TESTING PROCEDURES

Testing Procedure for DIO

Automated input with visual validation/confirmation of desired result

Sequence	Command	Expected Outcome	Message Received from MATLAB	Message Displayed on FlexPendant
1	VACUUMON	DO10_1 is set to value 1	-	Vacuum ON
2	SETSOLEN 1	DO10_2 is set to value 1	-	Vacuum Solenoid 1
3	SETSOLEN 0	DO10_2 is set to value 0	-	Vacuum Solenoid 0
4	VACUUMOF	DO10_1 is set to value 0	-	Vacuum OFF
5	CONVEYON	DO10_3 is set to value 1	-	Conveyor ON
6	CONVEYOF	DO10_3 is set to value 0	-	Conveyor OFF
7	CONVDIRE 1	DO10_4 is set to value 1	-	Conveyor Direction 1
8	CONVEYON	DO10_3 is set to value 1	-	Conveyor ON
9	CONVEYOF	DO10_3 is set to value 0	-	Conveyor OFF

Table 1 : Testing Procedure for DIOs

Testing for Motion:

Sequence	Command	Expected Outcome	Message received from Matlab	Message displayed on FlexPendant
1	MVPOSTAB 0,0,0	End effector moves to position T1 (175,0,147)	Movement Okay	Moving to: [0,0,0] rel. to pTableHome
2	EEPOSITN	Receive end effector position	[175,0,147] (within 5mm tolerance)	-
3	SETSPEED v200	Speed set to v200 i.e. Fast	-	-
4	MVPOSCON 0,0,0	End effector moves to position C1 (0,409,22)	Movement Okay	Moving to: [0,0,0] rel. to pConvHome
5	EEPOSITN	Receive end effector position	[0,409,22] (within 5mm tolerance)	-
6	SETSPEED v100	Speed set to v100 i.e. Medium	-	-
7	SETPOSES 10,10,10,10,10,10	Joint angles all set to 10 degrees	Movement Okay	Setting axes angles to: [10,10,10,10,10,10]
8	JNTANGLE	Receive joint angles	[10,10,10,10,10,10]	-
10	EEPOSITN	Receive end effector position (to check against position after orienting)	[465.5,86.7,449.9]	-
9	EEORIENT 0,0,1,0	End effector orientation set to 0,0,1,0 in quaternions (point down, -ve Z)	Movement Okay	Orienting end effector to: [0,0,1,0]
10	EEORIENT	Receive end effector orientation (in Euler angles)	[180,0,180] (rotation by Z, Y, then X)	-
11	EEPOSITN	Receive end effector position (to check against position before orienting)	[465.5,86.7,449.9] (within 5mm tolerance)	-

Table 2 : Testing Procedure for Motion tasks