# How to use the Snake Robot:

Setting up a Hand Gesture Control Demo:

Hardware Setup:

1. Turn on the Laptop Associated with the Snake Robot.
2. Switch on all 4 power switches on the power board
3. Connect the Leap Motion Controller (it is kept in the second yellow draw)
4. Check all Listed Connections: Leap motion, Ethernet to PMAC
5. Take the picking task objects from the second yellow draw and set up the demo
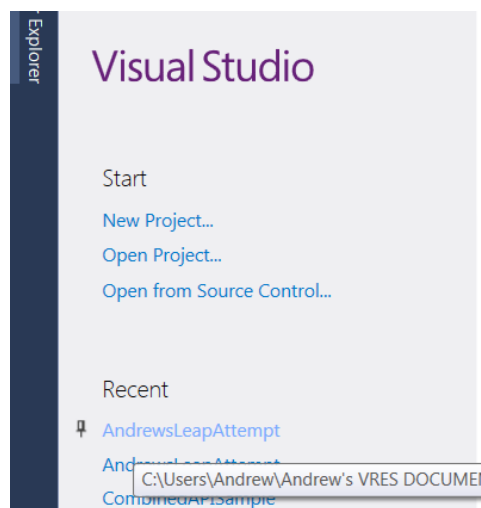
Software Setup:

6. Log in as Dr Liao Wu: Username: *wul20* Password: *Acrvs1162*
7. Go to start and run the leap motion visualiser. This is a test if the Leap motion controller is working i.e. it can see your hand
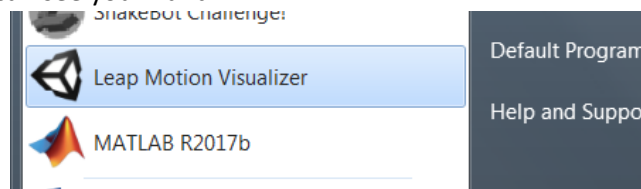
8. Go to start and run Microsoft Visual Studio 2015 under administrator privileges
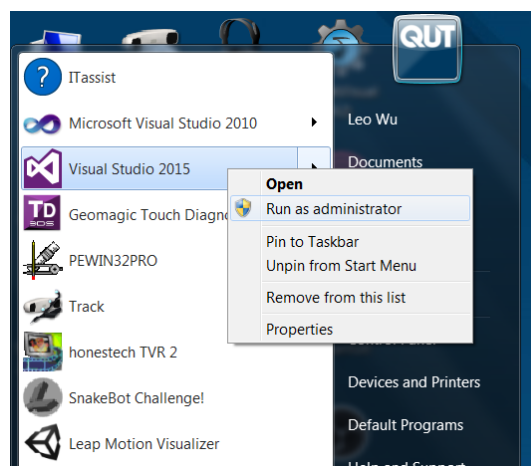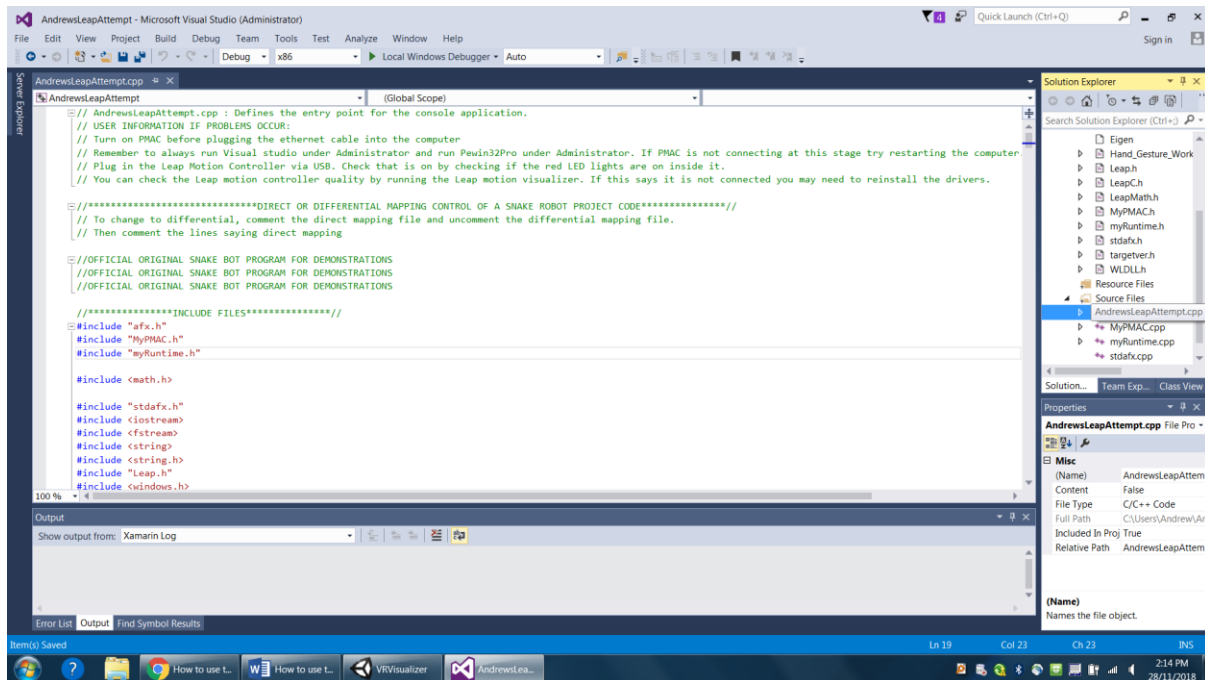

9. Click 'yes' to hardware changes and click the pinned file **AndrewsLeapAttempt**
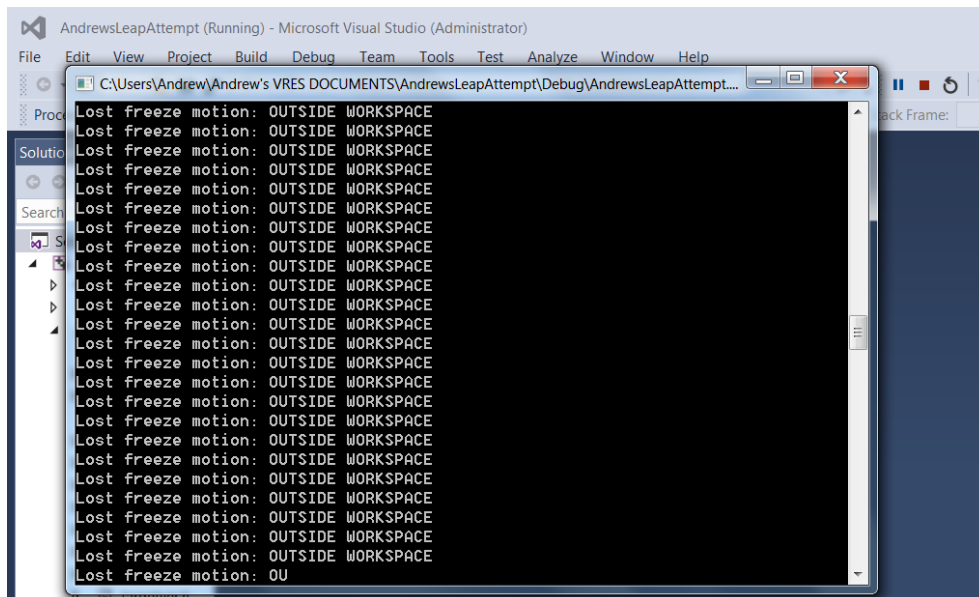
Running the Robot

10. Once opening the solution **AndrewsLeapAttempt**, run the debugger by pressing F5

11. A debugging terminal will appear explaining that the snake robot is running.

12. You can put this to the side and see the leap motion screen in the background of the demo however the snake robot only responds if the terminal was the last window to be clicked on.

13. The hand gestures to control the robot are listed here:

    a. Open hand means freeze/stop the motion of the robot. You can use this to move your hand towards a comfortable position while not moving the robot arm.

    b. Closed hand means to track the motion of your hand relative to where you started tracking. The robot moves relative to the centroid of your palm and orientation of that frame: that is the trajectory of your hand defines the trajectory of the robot tool (i.e. not necessarily where you point with the index finger).

  c. Make an L shape with your index finger and thumb to make the gripper open. The pinching distance between the thumb and index finger tells the robot whether to open or close the gripper.

14. After some time (around 10 to 15 seconds in inactivity) the snake robot resets itself and the terminal program closes.

# Setting up the Haptic Controller Demo:

Hardware Setup:

1. Turn on the Laptop Associated with the Snake Robot.
2. Switch on all 4 power switches on the power board
3. Connect haptic controller on the table. This uses an ethernet port to the computer and a power port which is under the table and comes from the power board.
4. Check all Listed Connections: Ethernet to PMAC, Ethernet to haptic, power to haptic
5. Take the picking task objects from the second yellow draw and set up the demo

Software Setup:

6. Log in as Dr Liao Wu: Username: *wul20* Password: *Acrvs1162*
7. Go to start and run Microsoft Visual Studio 2010 under administrator privileges
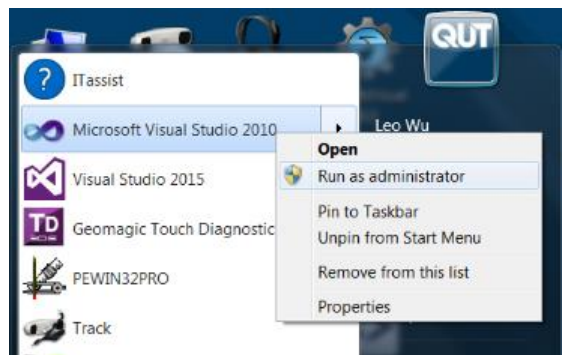
8. Click okay to hardware changes and click the pinned file **3DHaptics_TestGetMotionData**, this is the solution that runs the communication to the haptic controller
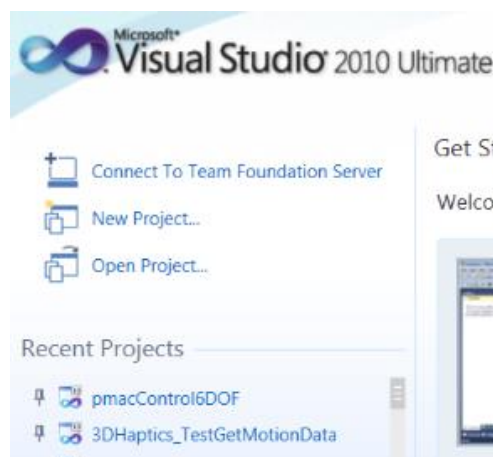

9. Go to start and run another instance of Microsoft Visual Studio 2010 under administrator privileges
10. Click okay to hardware changes and click the pinned file **pmacControl6DOF**, this is the solution that runs the snake robot control given the haptic communication

11. You will also need to open up the **PEWIN32PRO** program under admin privileges. You need to use this to reset the robot manually after running the robot


Running the Robot

12. Once opening both solutions, run the debugger for the **3DHaptics_TestGetMotionData** by pressing F5

13. A debugging terminal will appear explaining that the haptic device is ready provided that there is no error message.
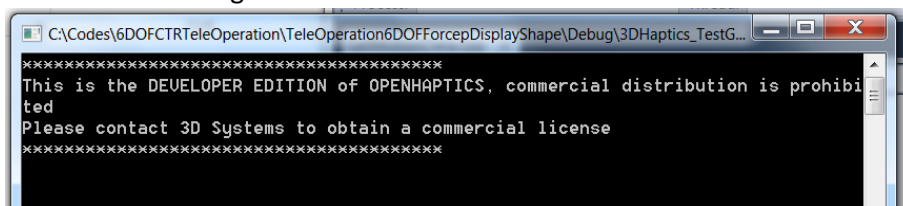

14. Now run the second solution **pmacControl6DOF** by pressing F5 it its window. A blank terminal appears and now the snake robot is ready to be controlled by the haptic device.
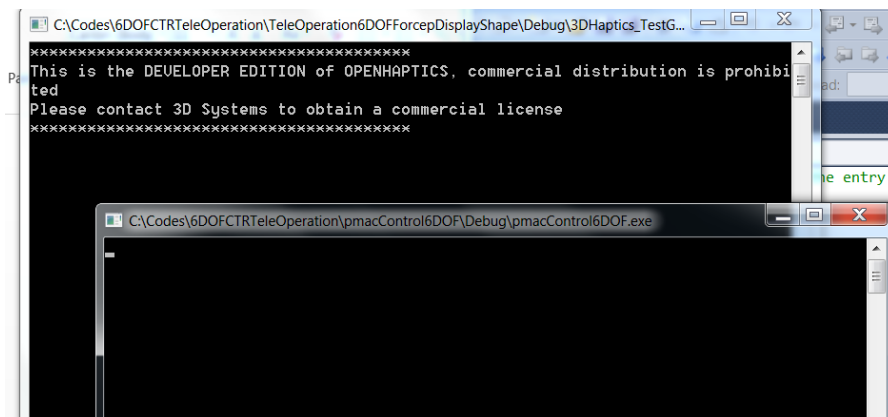
15. The haptic control scheme:
    a. To move the snake robot, take the haptic pen and press the side button closest to the tip of the pen (the dark grey one). This button tells the robot tool to follow the trajectory of the pen relative to the starting point of the motion.

b. Opening and closing the gripper is done by pressing the second button which the furthest from the tip of the pen (the light grey one). The button toggles the open/close state.

16. To turn off the robot you need to first close both debugging terminal windows and then open the Pewin32 program.
17. In the command window in the Pewin32 program you need reset the robot manually. Type the command into the terminal: **#1j=0 #2j=0 #3j=0 #4j=0 #5j=0 #6j=0 #7j=0**
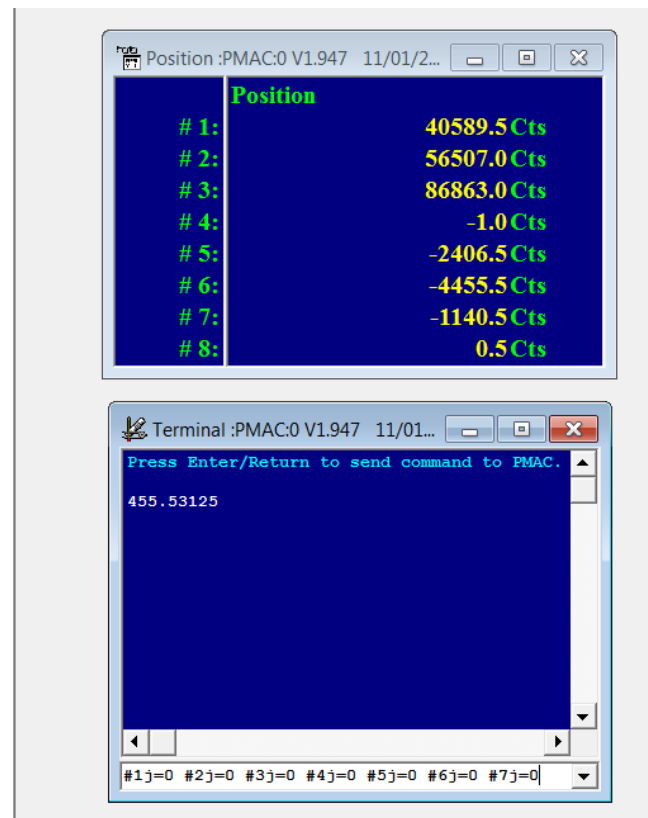
18. The command tells all 7 motors to 'jog' until they reach their 0 position. Soon all the motors would reset to 0 Cts (means counts of the motor position)

Pack down of the robot:

When finished follow the procedure:

1. Ensure the Visual studio codes have stopped running.
2. Close all the programs and shut down the computer.
3. Switch off the 4 switches on the power board.
4. Place the haptic device back behind the snake robot and pack the Leap motion controller and picking objects into the yellow second draw.

Troubleshooting Common problems:

1. **Leap motion not working or connected**: If it is plugged in (repetitively) yet not showing the visualisation, you may need to reinstall the drivers to see the device. Go to start and search 'install leap motion' click on the program and run the installation.

2. **3D haptics popping up an error**: If the 3D haptics screen is showing an error it may mean that the device is still booting or it is not powered or connected. Check the ethernet and power connection to the device, give it some time before running the 3D haptics code.
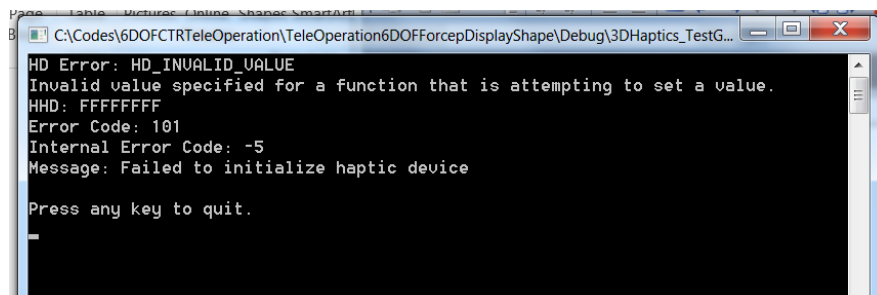
3. **No Snake robot motion/ connection failed** i.e. if Visual studio can't connect and Pewin32 can't send commands then you have this problem: Note only one program can actively use PMAC at a time. You must ensure that you are running under admin privileges to use PMAC. Check connections and if it still persists you also may need to restart the computer.