Teach Pendant to control Virtual Robots

Teach pendant programming provides an intuitive way to interact with industrial robots. It involves usage of a hand held control terminal called teach pendant that is used to control the motion of a robot. It provides a very convenient method to teach trajectories to the robot. Teach pendant programming does not place a significant burden on operator; it is easy to learn and doesn't require any specific technical skills. Using teach pendant operator can teach specific points/locations and path sequences to the robot. Hence, teach pendants can be used as a effective tools for visualization for educational purposes. But one of the major problems is that these devices are generally proprietary work of a specific robot manufacturer. Since only few institutes have robots as such setups are really expensive, the teach pendants are not available for use to a many students. This manual presents step-by-step instructions to make the teach pendant and controlling virtual robots using the client software. Visit www.RoboAnalyzer.com and download 'TeachPendantPackage.zip' for all relevant files.

Overview

This teach pendant has been developed to program robots in Virtual Robot Module (VRM) of RoboAnalyzer. The Teach pendant package contains a Client Application. It is a C# based application that interfaces teach pendant with VRM. The standard VRM software application was modified to act as a server in the form of a Dynamic Linked Library (DLL). The client software acts as a wrapper between the teach pendant and VRM as shown in the Fig.1. The microcontroller in the teach pendant has
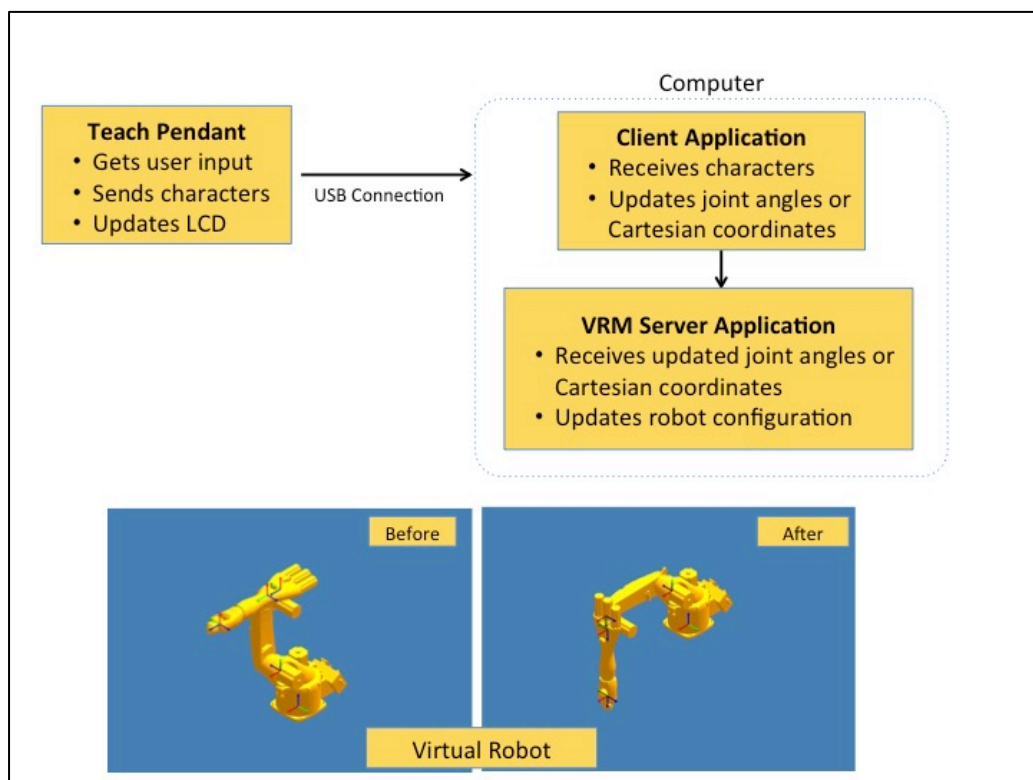

Fig.1 Integration of teach pendant with VRM

been programmed to generate characters on the event of a key press. These characters are transmitted using serial communication to a computer or another controller. Based on the characters received from teach pendant the client application calls the methods/functions of VirtualRobotClass in server application and updates the robot position.

Teach Pendant- DIY

The components uses in teach pendant is listed in Table 1.

TABLE 1. List of Components

Component	Qty.
20×4 LCD	1
4×4 Membrane/Matrix Keypad	1
Arduino Mega 2560	1
Pack of Jumper wires	-
2k resistance	1

Connect the pins of LCD and Membrane Keypad to the ports of Arduino Mega as mentioned in Table 1 and Table 2 respectively (Note: pin number for keypad and LCD is shown in Fig.2). The detailed circuit diagram is shown in the Fig.2.
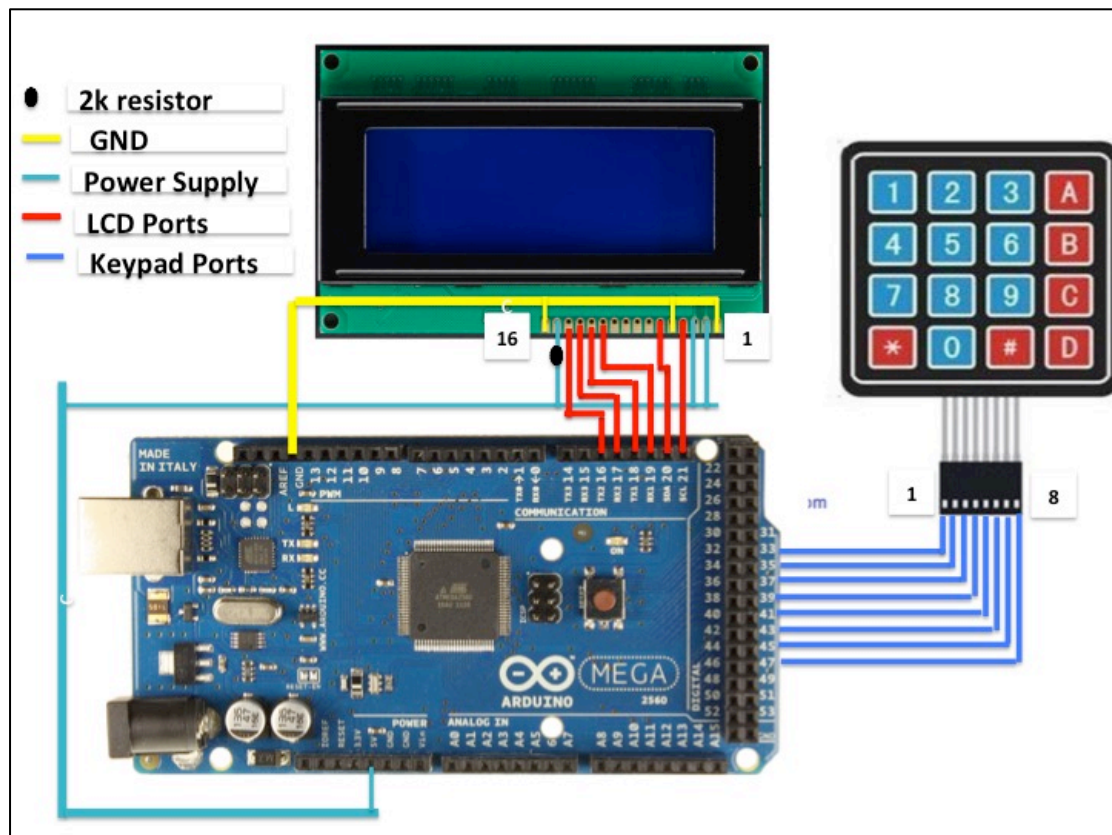

Fig.2 Circuit Diagram of Teach Pendant

TABLE 2.   LCD to Arduino port Description

LCD pin no.	1,5,16	2,3,15	4	6	11	12	13	14
Arduino port no.	GND	5V	21	20	19	18	17	16

TABLE 3.   Keypad to Arduino port Description

Keypad pin no.	1	2	3	4	5	6	7	8
Arduino port no.	33	35	37	39	41	43	45	47

Now download Arduino IDE from www.arduino.cc and install the software. The zip file package (shown in Fig.3) downloaded earlier contains a Arduino sketch in the name 'ArduinoCodeTeachPendant".

Upload this program to your Arduino Mega 2560. The Teach Pendant is ready for use.

The teach pendant has been programmed to generate characters on the event of key press. The program uses a search algorithm to identify the key pressed in matrix keypad In order to display the joint information; Arduino is programmed to count the joint values. So whenever any joint update key was pressed the respective joint value is updated and displayed on the LCD.
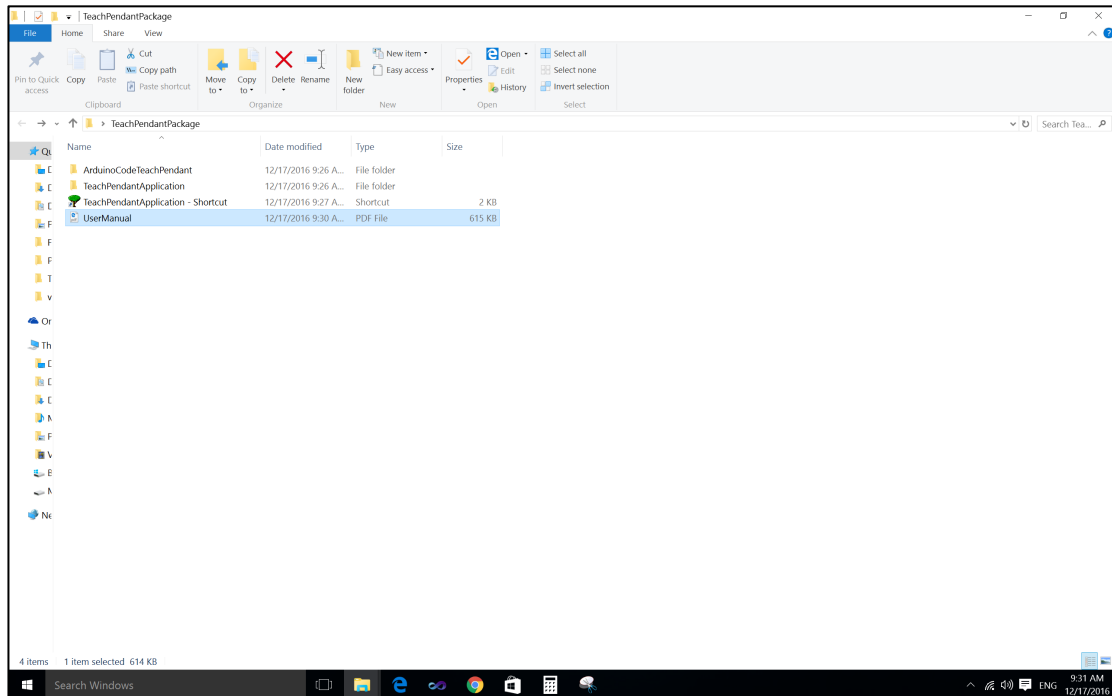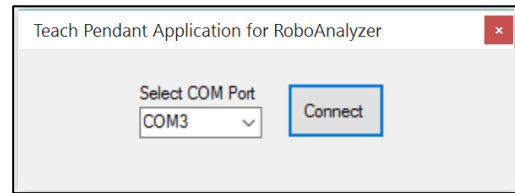

Fig.3 Contents of 'TeachPendantPacakage.zip'

Steps to Control Virtual Robot

- Connect your teach pendant to your PC.
- The package file downloaded earlier contains an application in the name of 'Teach Pendant Application'. Launch the application, a window will appear as shown in Fig 4. Select the COM port from the dropdown menu

Fig.4 Client application window

- Now hit the Connect button. A new window with virtual robot model will open up as shown in Fig.5. As you send commands from teach pendant the robot will update its position.
- By default teach pendant operates in Joint Jogging mode. The key description is shown in Fig.6. Use the joint update keys to update various joints. The speed of robot can be changed using speed update keys.

Fig,5 Virtual Robot model

- To operate the robot in Cartesian mode, switch to Cartesian mode using toggle key. Now the robot will execute motion in Cartesian space.
- To teach motion the virtual robot, first switch to Cartesian mode. Set the robot to home position using home button. Then Press '-' button of the teach keys, this will switch on the teach mode. Now move your robot in the desired manner and then again switch it back to home position. Now press '+' button from teach keys, the robot will playback the trajectory it was taught.
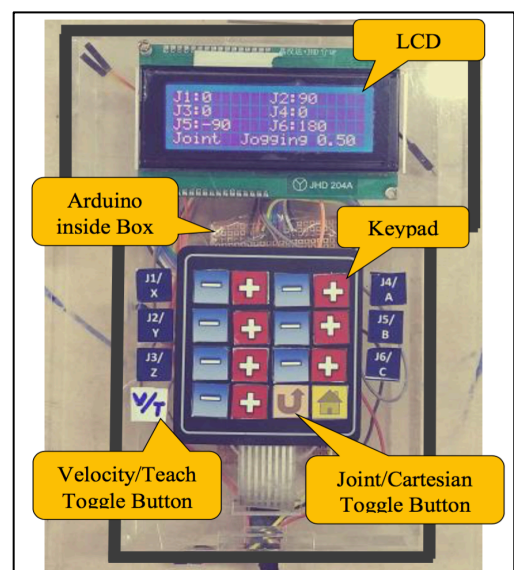

Fig.5 Key Description