Remote Control of Fanuc Robot Arms

Using Web Services via a Secure Internet Connection

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Abstract

The Advanced Digital Manufacturing Technology (ADMT) facility based at the UCLan Burnley Campus contains state of the art manufacturing technology, including Fanuc LRMate 200ic Robot Arms.

As part of ongoing research at ADMT there was a requirement to research, design and develop a web services based system for controlling the Fanuc Robot Arms.

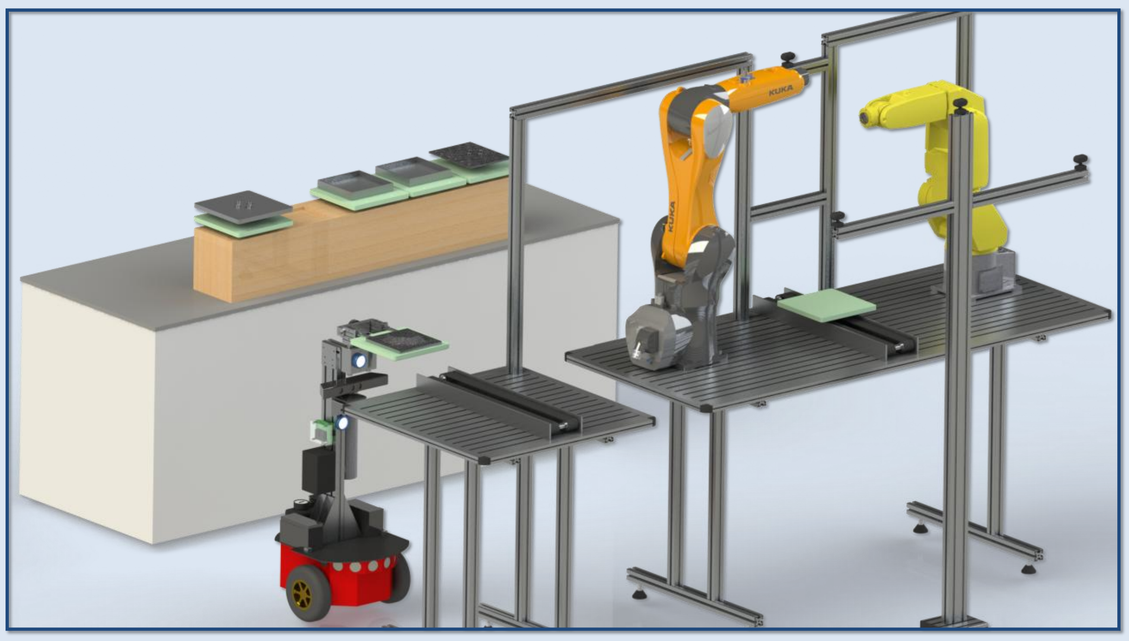
Research was carried out to determine the potential capabilities of the system and software was successfully designed and implemented during the project, allowing control of the robot arms via a web browser.

Introduction

Under normal circumstances an industrial Robot Arm is ‘taught’ movements using a teach pendant or similar device, movements are saved to programs stored on a controller which can then be replayed.

Whilst this works well for repeatable processes, if more control is required it is necessary to use something other than a teach pendant. An example of this might be using the Robot Arm to assemble a part it has not ‘seen’ before, this would require a vision system to relay positions to the robot, maybe using a webcam. In order to do this some form of software architecture is required, hence the need to be able to control the Robot Arm from a PC.

The image below shows part of the planned system, the aim for the future is for the three robots to be part of the same software architecture controlled by a Manufacturing Execution System (MES). This project was focused on researching a way to control the Fanuc Robot Arm from a PC to open up further research areas in cloud manufacturing, artificial intelligence and control systems.



Method

The first part of the project was to conduct research in order to assess the level of functionality achievable, this required studying documentation related to the Fanuc Robot Arms and software library.

Software was then developed which connects directly to the robot controller, with the following capabilities:

- Connect to a Robot Arm
- Return a list of available programs
- Run a program stored on the Robot Controller
- Instruct the Robot Arm to move to a specific point
- Return the current position of the Robot Arm

Once this was completed, further software was developed to allow another PC on the same local network access to the stated capabilities. To achieve this a feature of the .NET framework called ‘Remoting’ was used. This was required as the software library provided by Fanuc had to be licensed to a single machine.

A web server on the ADMT network was set up, using IIS to host an ASPX page, services behind this page call functions in software remotely in order to control the robot and return position status updates.

Due to potential safety and security issues, control was not opened to access from the internet.

Conclusions

Currently the system allows some control of the Robot Arms via a web browser on the ADMT local network, a phone application could also be developed to provide the same control. To extend the system further more research is required into using standard HTTP requests, this would then allow access from outside the ADMT network.

There are limitations as to how the Robot Arm can be driven. Programs can be run remotely and parameters used within the programs can be changed. However, safety commands such as an emergency stop cannot be issued at present, to do this a separate software module to communicate with the PLC’s on the network is required, this is the main reason internet based control was not implemented.

Further research should focus on security, how the framework can be extended, abstracting the hardware from the user and working towards the idea of cloud manufacturing.

System Overview