

Enhancement of Industrial Automation Using Single Board Computer Network

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desirable to workers. The future of industrial automation belongs to Real-time systems will give way to complex

ABSTRACT

Automation plays an increasingly important role in the economy and in daily experiences. In the scope of industrialization mechanization .Whereas mechanization provided human operators with machinery to assist them with the muscular requirement of work, automation greatly reduces the need of human sensory & mental requirements. Industrial automation can and will generate explosive growth with the technologies related to new inflation points: nanotechnology, pervasive internet and machine to machine networking (M2M) etc. In this work, architecture for web based industrial automation is presented by the use of single board computers in a LAN/WAN network. This architecture provides additional features of security, portability and ease of access etc.

General Terms

1. Automation

It is the use of various control systems for operating equipment such as machinery, processes in factories, boilers and heat treating ovens, switching in telephone networks, steering and stabilization of ships, aircraft and other applications with minimal or reduced human intervention

2. PLC

It is a digital computer used for automation of electromechanical process.

Keywords: Industrial Automation, Single Board computers, PLC

1. INTRODUCTION

Industrial automation is the use of robotic devices to complete manufacturing tasks. In this day and age of computers, it is becoming increasingly important in the manufacturing process because computerized or robotic machines are capable of handling repetitive tasks quickly and efficiently. Machines used in this field are also capable of completing mundane tasks that are not

adaptive systems and multi-processing and nanotech, wireless everything, and complex adaptive systems. Major new software applications will be in wireless sensors and distributed peer-to-peer networks – tiny operating systems in wireless sensor nodes, and the software that allows nodes to communicate with each other as a larger complex adaptive system.

2. DEVELOPMENTS IN INDUSTRIAL AUTOMATION SYSTEMS

Over the past few decades, some innovations have indeed given industrial automation new surges of growth: The programmable logic controller (PLC) – developed by Dick Morley and others – was designed to replace relay-logic; it generated growth in applications where custom logic was difficult to implement and change. The PLC was a lot more reliable than relay-contacts, and much easier to program and reprogram. Growth was rapid in automobile test-installations, which had to be re-programmed often for new car models. The PLC has had a long and productive life – some three decades – and (understandably) has now become a commodity.

At about the same time that the PLC was developed, another surge of innovation came through the use of computers for control systems. Mini-computers replaced large central mainframes in central control rooms, and gave rise to "distributed" control systems (DCS), pioneered by Honeywell with its TDC 2000. But, these were not really "distributed" because they were still relatively large clumps of computer hardware and cabinets filled with I/O connections. But now automation software has had its day, and can't go much further. No "inflection point" here. In the future, software will embed within products and systems, with no major independent innovation on the horizon. The plethora of manufacturing software solutions and services will yield significant results, but all as part of other systems. So in order to make it more efficient and secure I here proposed an architecture for the web based industrial automation system using single board computers which is more efficient than traditional automation systems.

3. ARCHITECTURE

a. OVERVIEW OF WORKING

The architecture consists of a network of single board computers that are used to control the PLC of connected drives and machines. The single board computers are connected in the network using the routers and switches. A web server is running on the on the single board computers that will accept the requests from the clients or operators web browser based web application designed for the control of the system.

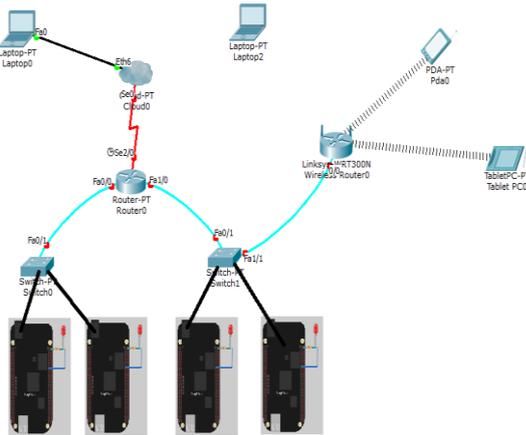


Fig. Single Board computers connected in network

All the PLC's are connected in the same network using single board computers so that they can communicate to each other if required that will increase its efficiency. The web application can be accessed from anywhere using internet via mobile, laptop or iPods etc. The web application running at client side can be made secure using encryption and passwords.

4. SOFTWARE COMPONENTS

3.2.1 Web Server

We use lighttpd as our web server running on beaglebone black single board computer but we can also use apache Tomcat server for the same. After installing lighttpd we need to configure it for the beaglebone black environment of Linux.

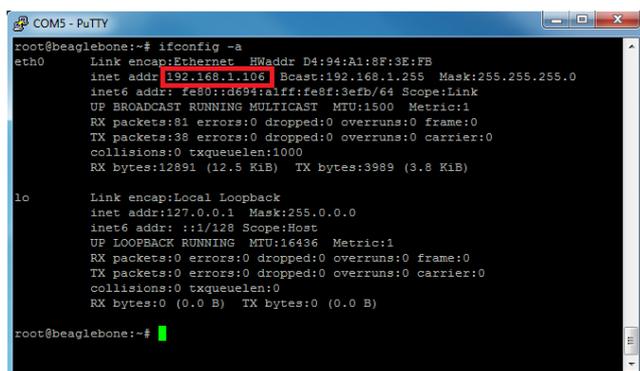
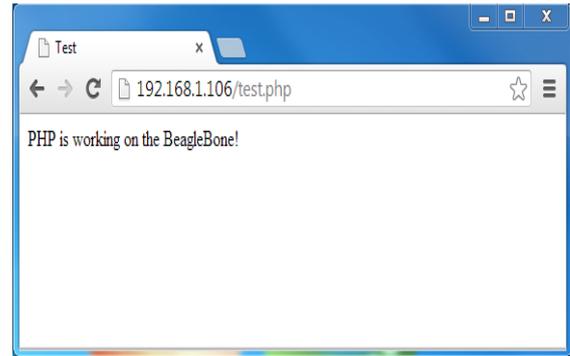


Fig. Find out IP address of web server



3.2.2 PHP and Java Run Time Environment

We need to install PHP and JRE for running the application programs on the web server.

3.2.3 Client Side Web Application

A web application for control of PLC's is designed for efficient control. It can be designed using a no of web technologies like JSP, Servlets and ASP etc.

5. HARDWARE

Routers and switches

Any company routers and switches can be used for creating the network. ie Cisco 3700 series

Single Board computer

Here, I am using a beaglebone black embedded single board computer. It consists of all the features of a that are required to control the PLC's .It consists of an Arm processor with some Linux distribution installed on it.

ii. End devices with Browser support

Mobile, laptop and iPods can be used as end devices for controlling the plant or industry.

6. SOFTWARE CODE EXAMPLE

PLC control web application Example

```

<html>
<head>
<title>BeagleBone PLC Control</title>
<style type="text/css">
p { display: table-cell; }
button { width: 75px; margin: 2px auto; }
</style>
<?php
if (isset($_GET['PLC']) && isset($_GET['onOff']))
{
$led = $_GET['PLC'];
$onOff = $_GET['onOff'];

exec( "/www/cgi-bin/ledctl $PLC $onOff" );
    
```

```

}
?>
</head>
<body>
<div style="width: 200px; margin: 0px auto;">
<div style="width: 100px; float: left;">
<p>PLC #2:</p>
<button type="button"
onclick="location.href='PLCCtl.php?PLC=2&onOff=1'"
>ON</button>
<button type="button"
onclick="location.href='PLCCtl.php?PLC=2&onOff=0'"
>OFF</button>
</div>
<div style="width: 100px; margin-left: 100px;">
<p>PLC #3:</p>
<button type="button"
onclick="location.href='PLCCtl.php?PLC=3&onOff=1'"
>ON</button>
<button type="button"
onclick="location.href='PLCCtl.php?PLC=3&onOff=0'"
>OFF</button>
</div>
</div>
</body>
</html>
    
```

7. TESTING

Initially, the target is tested for the working of operating system. This is done by booting the target using the hyper terminal. After the target is successfully booted with Linux, it is tested over the network using ping command.

Now the embedded web server is responding to the clients, request is made to the server, embedded web server, by typing the IP address of the server in the client's browser. The user has to enter '10.1.1.26' IP to access the server. This request is taken by the operating system of the client and given to the LAN controller of the client system. The LAN controller sends the request to the router that processes and checks for the system connected to the network with the particular IP address. If the IP address entered is correct and matches to that of the server, a request is sent to the LAN controller of the server and a session is established and a TCP/IP connection is establishes and the server starts sending the web pages to the client.

8. CONCLUSION

To contribute to the evaluating process of searching the appropriate designing paradigms as a developer of embedded systems, I bring up in this paper some of my ideas for the design of efficient industrial automation solutions concretely. The goal that we discussed here is

purely a matter of networked intelligence which is now well developed and widely available. The proposed architecture of industrial automation will provide higher consistency and quality ,simplification of production and improve work flow of production.

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