

Iwan Downs Project Report

by Iwan CostelloDowns

FILE	12714_IWAN_COSTELLODOWNS_IWAN_DOWNS_PROJECT_REPORT_172462_41064597.PDF (1.76M)		
TIME SUBMITTED	17-MAY-2020 12:30AM (UTC+0100)	WORD COUNT	3744
SUBMISSION ID	127912282	CHARACTER COUNT	18701

HNC Electrical and Electronic Engineering **Project - SGEE4006**

Iwan Downs – Industrial Remote Control **and Monitoring Using Web Technologies**

Table of Contents

1.Introduction and Background Research	2
2.Specification	3
3. Planning	6
4.Solutions Considered	8
5.Final Solution and Implementation	9
6.Testing and Results.....	31
7.Discussion, Conclusions and Recommendations	35
8.Reference list and Bibliography	36

*The contents should contain sub divisions
to show more detail*

1.Introduction and Background Research

The objective of the project is to update the existing process rig in Fig,1 to IoT and industry 4.0 using web technologies this will be achieved by enabling the remote control & monitoring of the process rig system using PLC tags in a http program in conjunction with the PLC web server for data access. Using this method, it should be possible to send and retrieve parameters from the PLC to any IP device using wireless protocols.



Fig.1 – Process Rig

Industry 4.0 is the trend for manufacturing plants to have systems which are connected with either IO link or wireless connectivity and smart sensors, connected to a system that can communicate along the entire production line and operate with minimal human oversight. In essence, industry 4.0 is the trend towards automated information exchange between system control and sensors. (PI News, 2016)

Good point about IOT.

The use of integrated manufacturing systems has a multitude of benefits such as, by machine data it can anticipate when specific maintenance is needed such as when a component wears out be it mechanical or electrical. This type of maintenance is known as predictive maintenance and is carried out to prevent machine downtime. (I-Scoop, 2019)

The PLC in built web server has multiple feature that make it useful for this specification. Such as no additional hardware and software are required the server is built in.

The web server is contained in the S7-1200 CPU as a standard feature. The Integrated web server can display standard web pages for simple display of services and diagnostic information.

Furthermore, access to the PLC is possible world-wide via a standard Internet browser as well as via mobile communication devices, such as tablet PC, smart phone, etc with IP addressing. For this reason, individual access and protection must be taken and a password protection can be added.

The universal advantages of this tools are evident and usage of this application for all S7-1200 controllers in factories and production lines would greatly increase efficiency and reduce downtime.

(Siemens, 2020), (Jager, 2013)

The web page would be constructed in HTML, which is not a programming language; it is a mark-up language that defines the of the page. HTML consists of a series of elements, which are used to compartmentalise different parts of the content to make it appear in a specific format. The enclosing tags can make a word or image hyperlink to somewhere else, can italicize words, can make the font bigger or smaller, and so on. The best way to edit HTML documents is with Dreamweaver a paid for web design software pack.

*some
grammatical
errors*

(MDN WebDocs, 2020)

AJAX is Asynchronous JavaScript and XML, which is used on the client side as a group of interrelated web development techniques, in order to create asynchronous web applications. AJAX designed web pages allow applications to send and retrieve data from a client asynchronously without interfering with the display and the behaviour of the existing page meaning no refreshing flickering.

The idea is to use JSON to pass AJAX updates between the PC and the PLC web server. For example the tag values have to be updated on the web page, then they must be stored on the server so that the web page can retrieve the tag values when it is required. This is where we can make use of JSON formatted data.

Any data that is updated using AJAX can be stored using the JSON format on the web server. AJAX is used so that javascript can retrieve these JSON files when necessary, parse them, and perform one of the following operations –

Store the parsed values in the variables for further processing before displaying them on the webpage.

It directly assigns the data to the DOM elements in the webpage, so that they are displayed on the website.

(TutorialsPoint, 2020)

Good research carried out and the explanations are clear.

HTML will provide the framework for the page but when it comes to calling tags in JSON or XML can be used. JSON stands for JavaScript Object Notation. For transferring data between server and client JSON objects are used. XML is another service that is similar. However, JSON is much more light weight compared to XML which is a consideration as we are on a memory limit. Ajax enables the function to call a dynamic variable and monitor or read/write the variable using a let interval reload parameter which only reloads a select part of the page and not the whole page, but it can only call a single function result i.e. one tag value. Json is an extension on Ajax and uses the jQuery library. Json allows many function calls to many variables.

(Freeman, 2019)

Research is good with relevant sources cited but there some grammatical errors

2.Specification

The project must by the end of the allotted construction phase must be able to control tag values and input data using a remote method of access via the web server, if this is achieved the project can be considered as success.

The project should be completed by April 2020 and the report by May, a corresponding Gantt chart will be made to track progress to ensure it is completed on time.

The budget for the project was agreed upon in the project proposal. Given that all tools needed for the project are readily available no money will have to be spent to complete it.

Approx. value of the project would be around £1900 if materials were not available.

Iwan Downs

HMI – £800

PLC – £130

TIA Portal – £900

Dreamweaver – £40

*Good breakdown
of costs*

Router – £20

As for the environmental and sustainable implications, the project is almost entirely virtual and will produce no waste and designed to make a system even more efficient which would reduce running costs. Initial cost of a system is also low as everything required is already present, if this were undertaken in industry the only initial consideration would be downtime for installation and setup. The actual project is rather simple once all aspects of setup are understood, it is the initial learning curve that is the greatest challenge.

The project possesses no safety or environmental issues other than the use of low levels of DC electricity and is aided to make consumer and user needs simpler by optimising the PLC system.

*Good point
made
about
environmental impact*

3. Planning

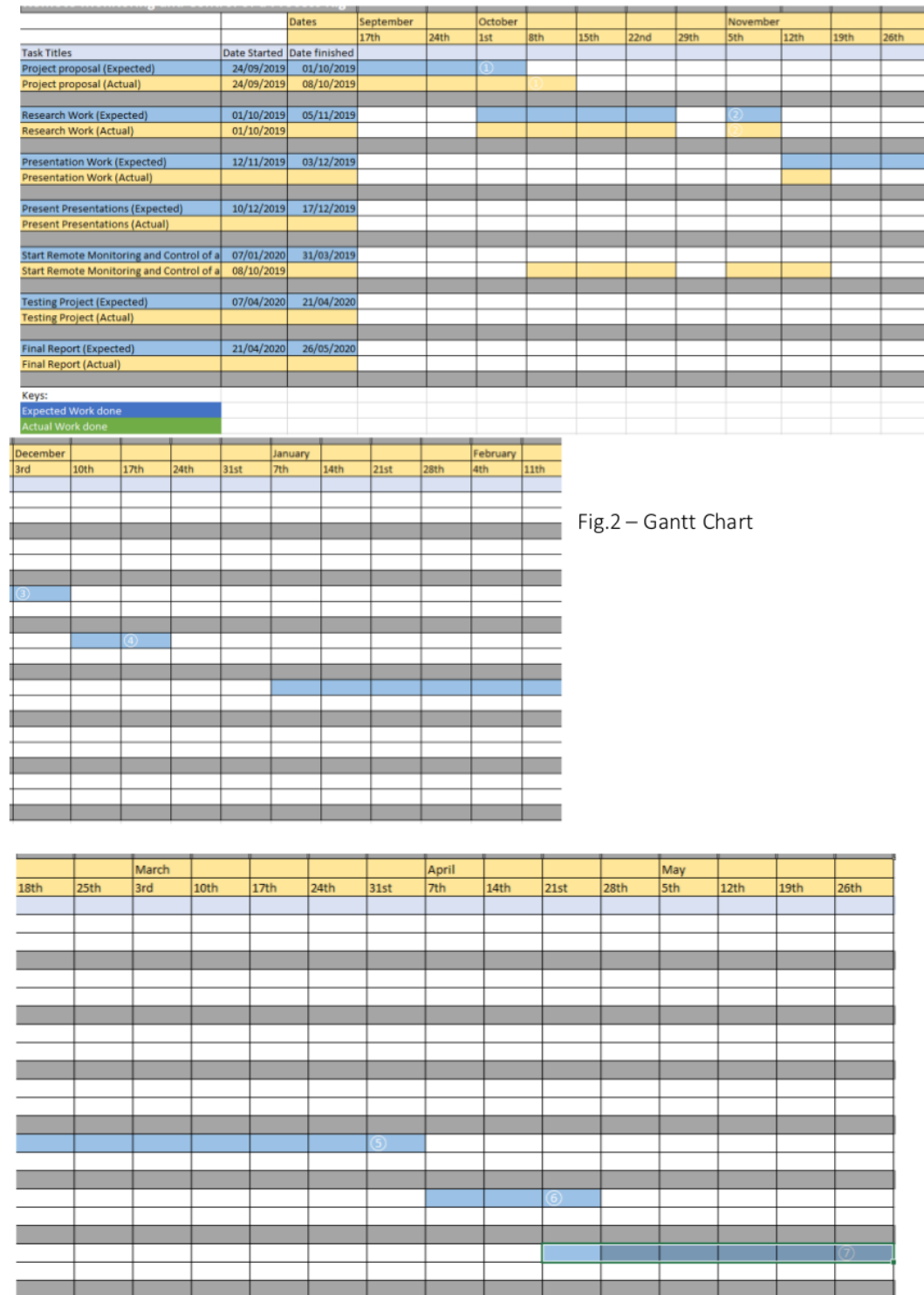


Fig.2 – Gantt Chart

Good use of Gantt chart but it is not clear when the actual activities took place. It seems incomplete.

As seen in Fig.2 the Gantt chart for project construction can be seen. A large deal of time will have to be devoted to understanding and implementing the tag functions for the web server as this is relatively new ground.

When the task is done a set of tests must be carried out to ensure that the project meets the specification criteria. This will be done with the use of a testing table with relevant pictures to provide as evidence of the testing and can be used to judge whether the project has passed or failed based on the criteria in the specification.

4.Solutions Considered

The two solutions considered were the PLC with the integrated web server and a SCADA system.

The advantages to the PLC are that the system is relatively simple and uses IP addressing set by software by the admin. And that the web server tool is built in and free, furthermore the tools used to make the web page are free open source software. The only downside is that the project is front loaded, and a lot of research and trial and error would be involved in prototyping and developing the system.

The SCADA system would be quicker to make as specific software and devices can be bought and tailored specifically for a specific system, the process would require less trial and error but would be a professional spec system. This however is overkill for a system like this and the software for this approach would cost a significant amount of money.

The programs needed for the PLC method are.

- ◆ TIA Portal
- ◆ HTML Open Source
- ◆ AJAX Open Source
- ◆ HTTP Protocol

All of which access to is readily available already or with open source free software.

Therefore the PLC method is the best choice to satisfy the project specification.

*There
needs to
be more
details and
explanation
of how a
Siemens
SCADA .ie
Wincc is a
reasonable
alternative
and how it
would
work.*

5.Final Solution and Implementation

Industry uses VLAN networks for system separation and security. This system will use the same principle.

VLAN will be configured using the Cisco switch and router.

The PLC will be programmed and configured using the TIA Portal development environment.

The Web comms will be achieved using a specific web program which will be downloaded to the PLC.

The Web page and wireless adapter will enable remote monitoring and control using AWP commands.

There is a range of addressing schemes that can be used, but sometimes the limits are set by the network devices such as routers (e.g. BT routers have addresses from 192.168.2.1 – 192.168.2.170). There will be network limitations to consider.

The project will test both variable control through dynamic analogue control as well as dynamic input/output functionality. Fig.3 is a block diagram of how the system will work.

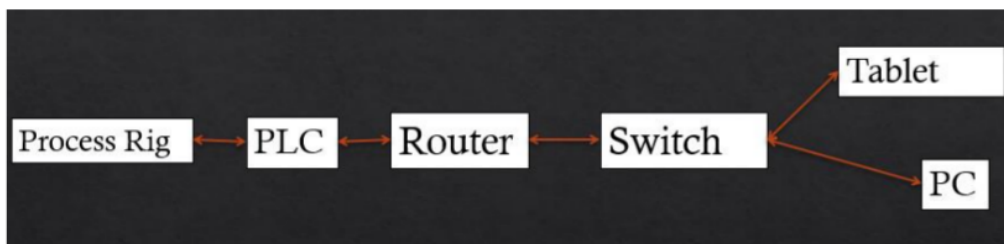


Fig.3 – Block Diagram

The PLC is the Ethernet device with NIC card with MAC Address This is a layer 1 device

The PC for writing the program for the PLC has a NIC card and MAC Address. This is layer 1 device

The Cisco switch which communicates using only Mac Addresses is a layer 2 device.

The Cisco router which communicates using IP addresses. This is a layer 3 device.

Fig.4 shows the different levels of network comms in the system and Fig,5 shows the hardware used.

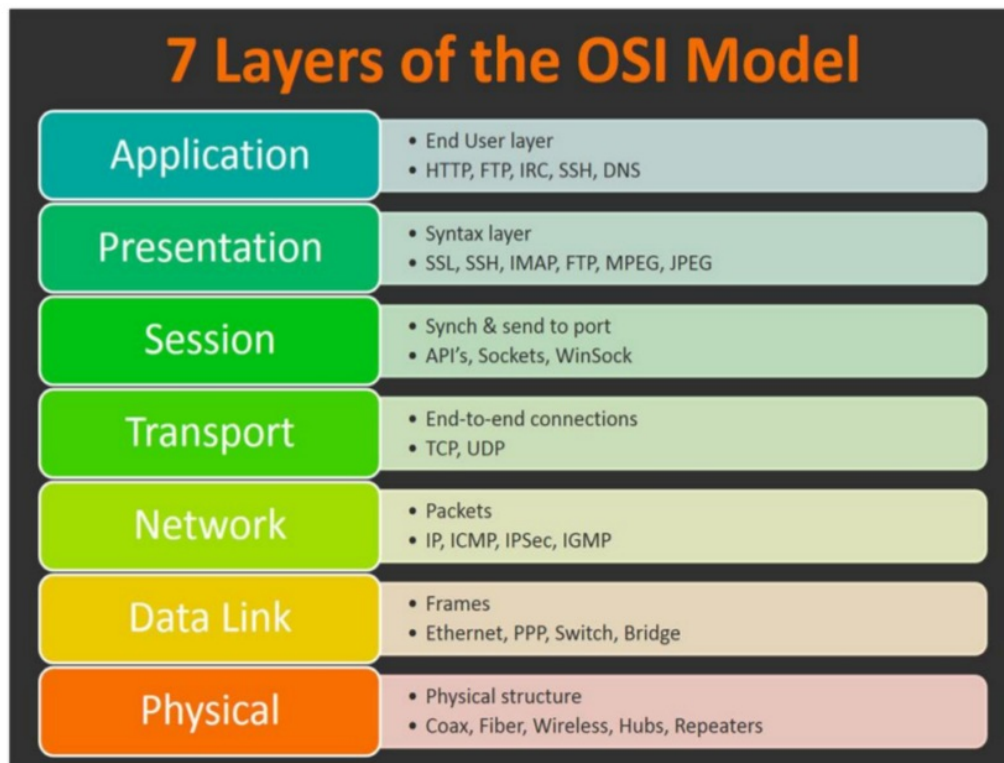


Fig.4 – OSI Model Diagram



Fig.5 – Hardware Use

OSI devices are identified for use in this project and are part of the 7 layer model.

Iwan Downs

In Fig.6 the PLC program and Web memory blocks used can be visualised.

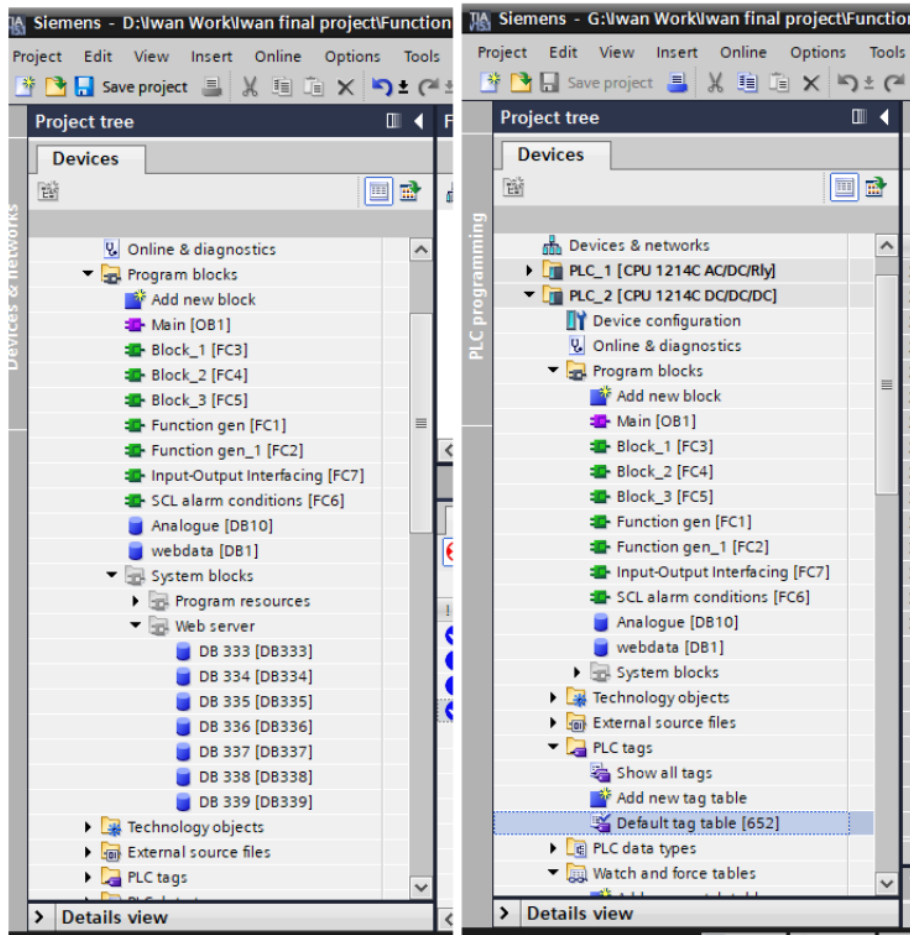


Fig.6 – PLC Architecture

*Good
illustration
of PLC
program
tree*

The web server has to be set up manually in the PLC as seen in Fig.6, to allow administrator controls and the allow the PLC to communicate.

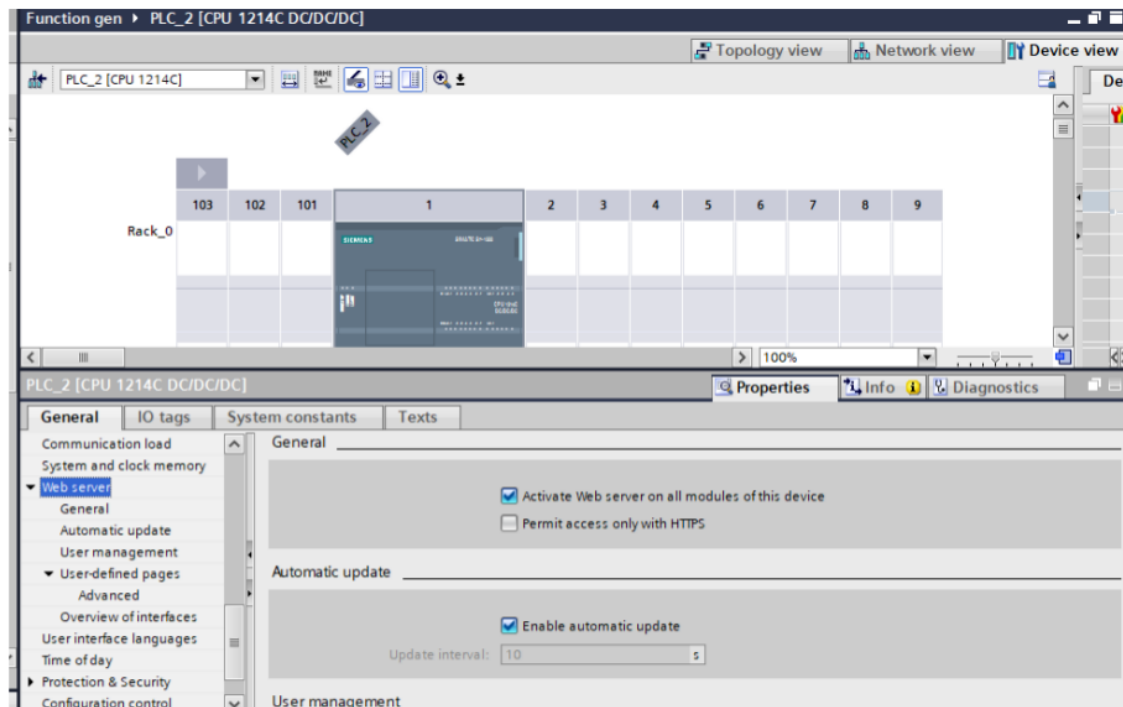


Fig.7 – PLC Web Server Setup

Good image of web server activation inside PLC TIA application.

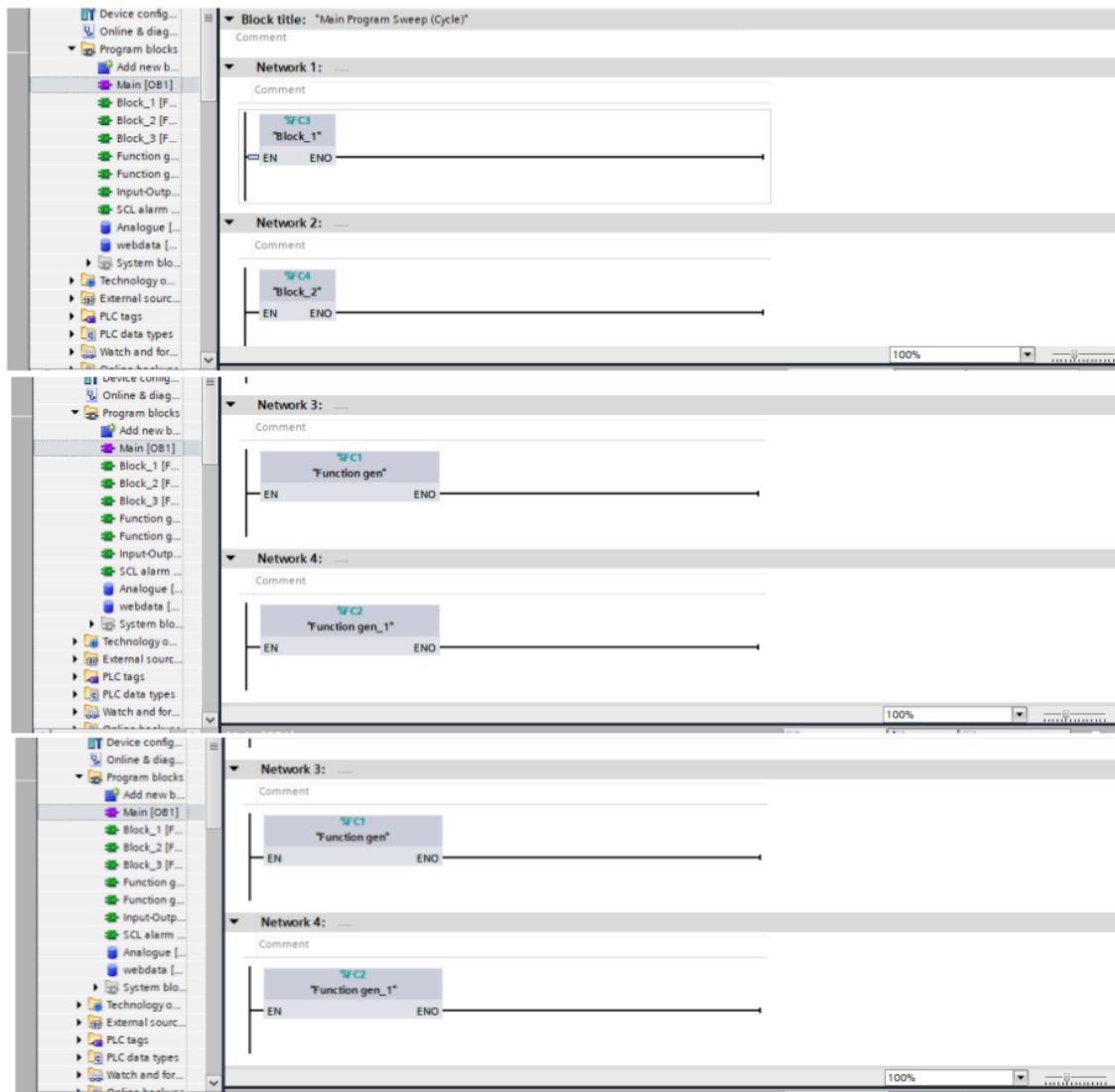


Fig.8 – PLC Main Block

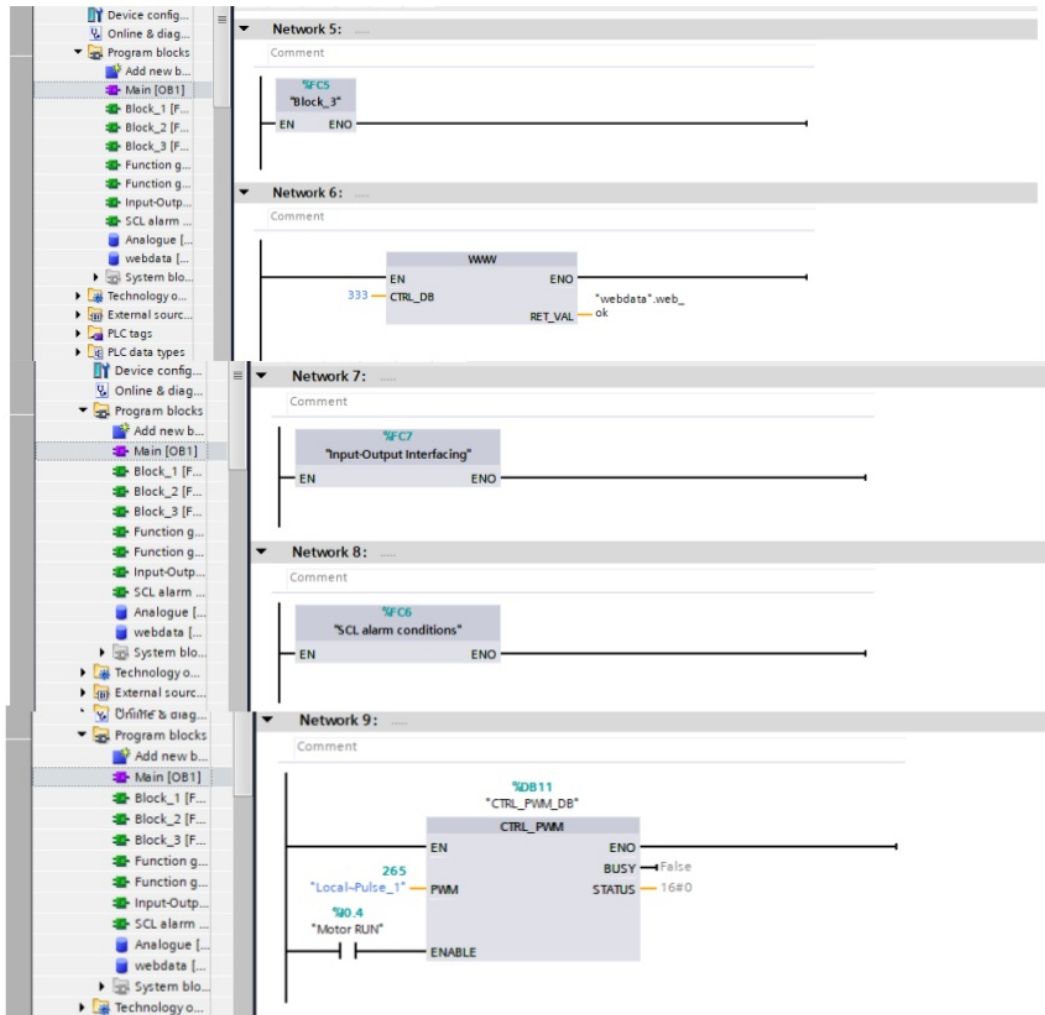


Fig.9 – PLC Main Block Cont

Function Block 1 for the tag data conversion to the web data counter.

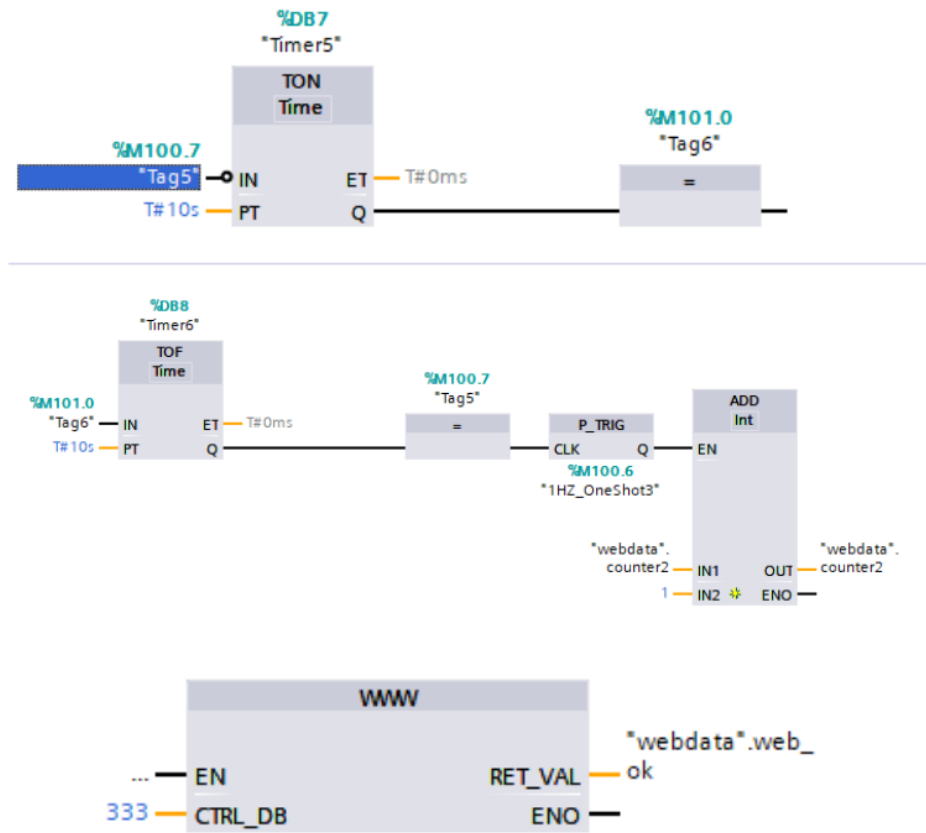


Fig.10 – Function Block 1

Function Block 2 for the tag data conversion to the web data counter.

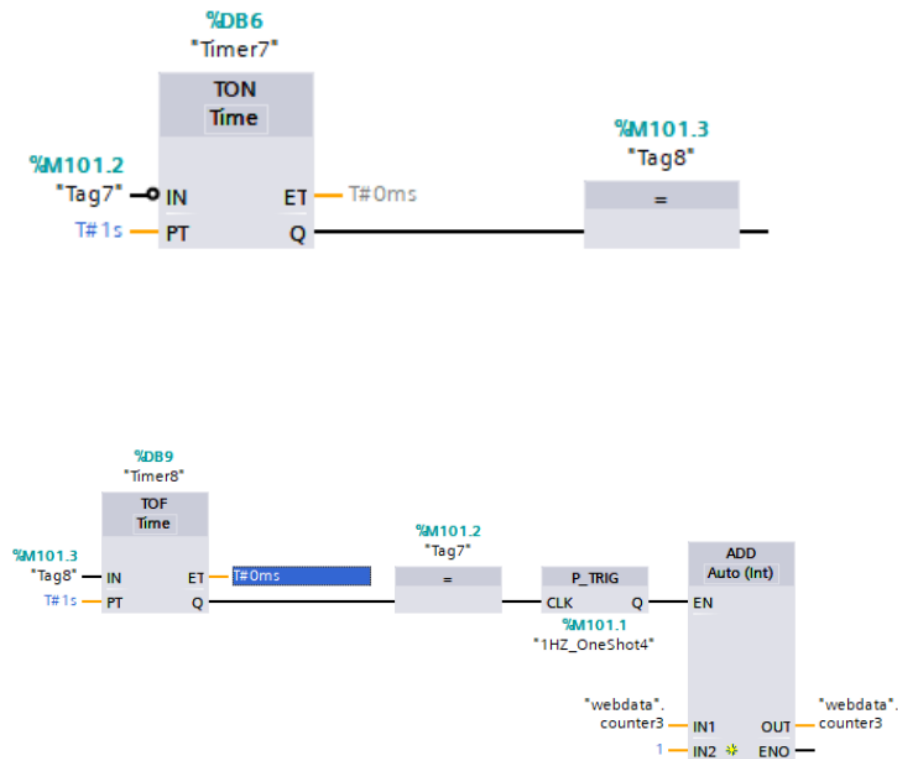


Fig.11 – Function Block 2

Function gen block for the web data counter.

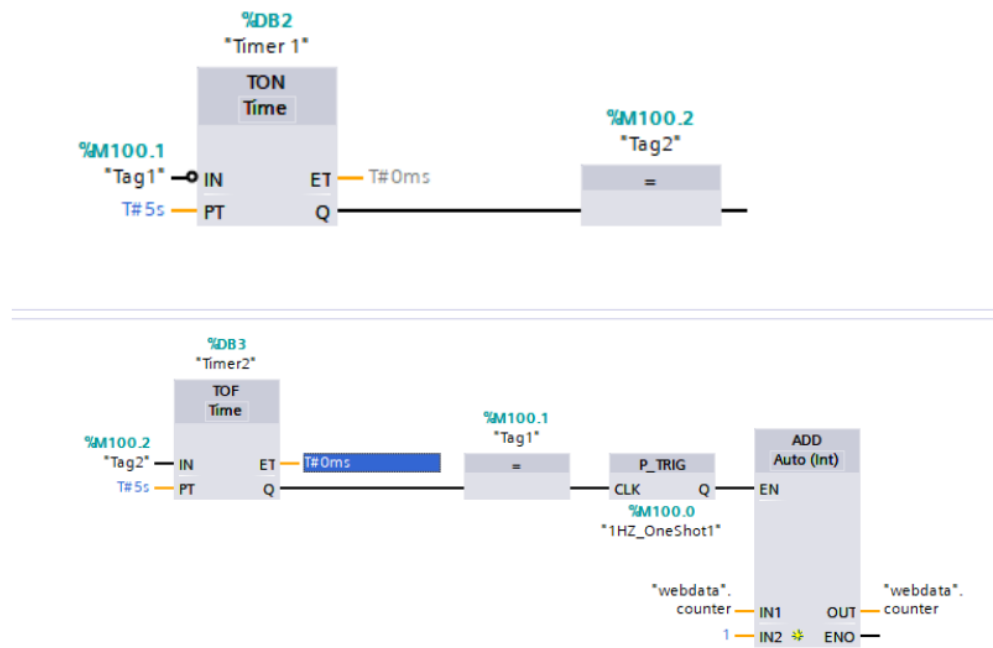


Fig.12 – Function Gen Block

Function gen block 2 for the web data counter.

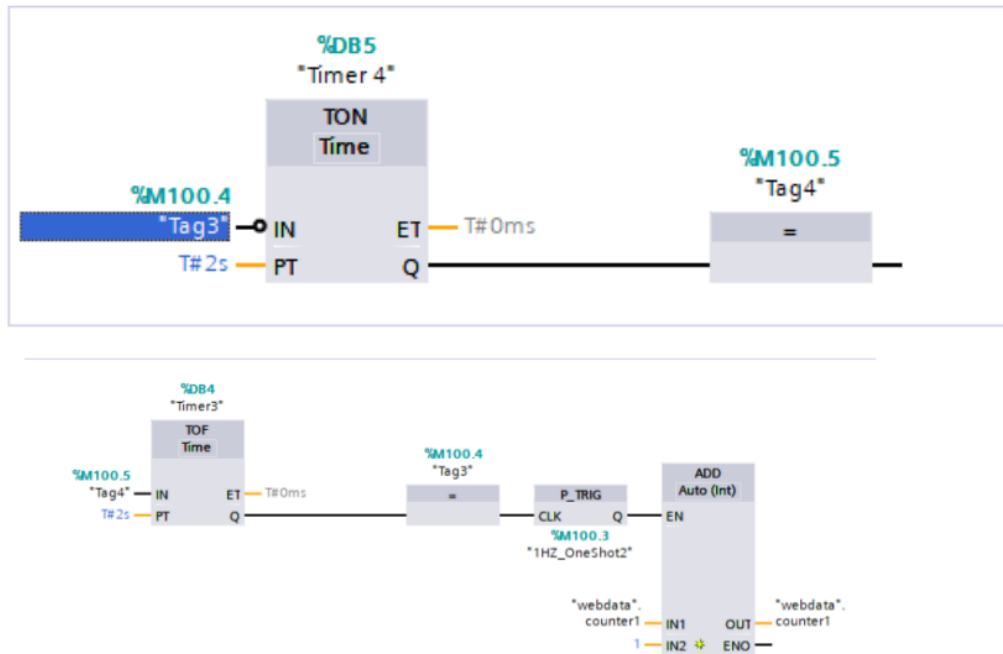


Fig.13 – Function Gen Block 2

Analogue input for the dynamic analogue control motor.

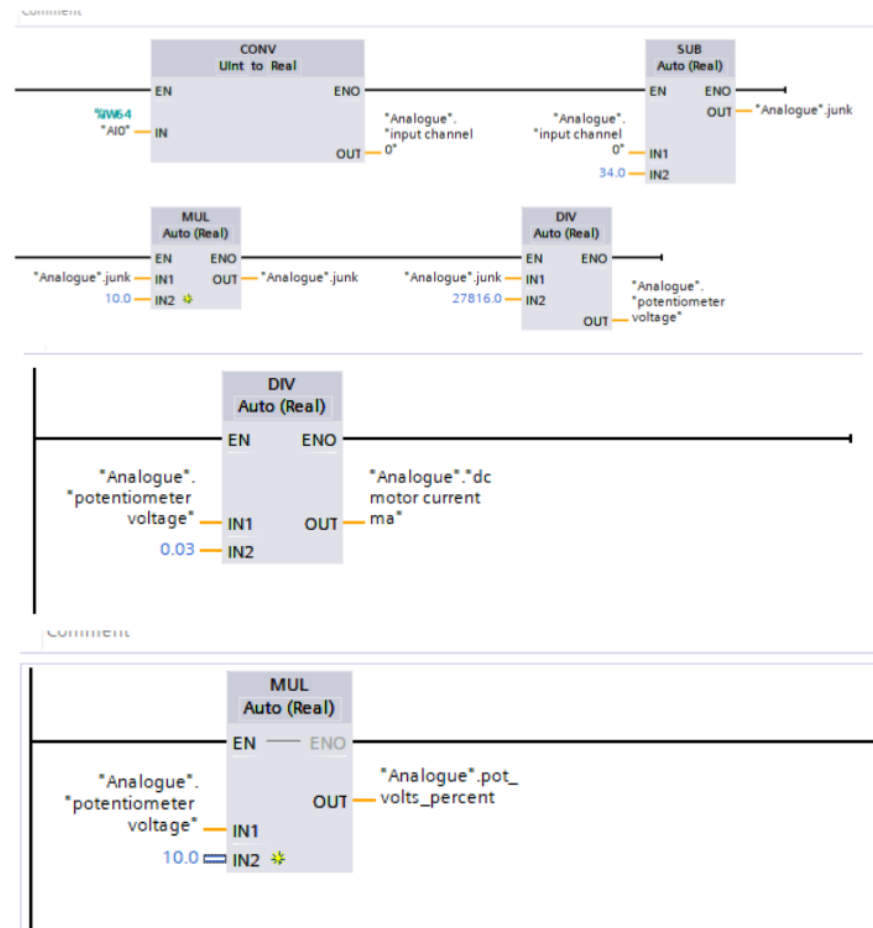


Fig.14 – Analogue input Block

Analogue data block for the dynamic analogue control.

	Name	Data type	Start value
	Static		
	input channel 0	Real	0.0
	input channel 1	Real	0.0
	junk	Real	0.0
	potentiometer voltage	Real	0.0
	pot_volts_percent	Real	0.0
	Alarm1	Bool	false
	Alarm2	Bool	false
	Alarm3	Bool	false
	Alarm4	Bool	false
	Alarm5	Bool	false
	Alarm6	Bool	false
	Alarm0	Bool	false
	dc motor current ma	Real	0.0

Fig.15 – Analogue Data Block

Webdata block which handles data for the for the web server.

Name	Data type	Start value	Re
Static			
counter	Int	0	
web_ok	Int	0	
counter1	Int	0	
counter2	Int	0	
counter3	Int	0	
myInt	Int	0	
count_continuous	Int	0	
triangleWave	Int	0	
triangleDirection	Int	0	
Motor_PWM	Int	0	

Fig.16 – Webdata Data Block

Default tag table containing program tags.

	Name	Data type	Address
1	Tag1	Bool	%M100.1
2	Tag2	Bool	%M100.2
3	1HZ_OneShot2	Bool	%M100.3
4	Tag3	Bool	%M100.4
5	Tag4	Bool	%M100.5
6	1HZ_OneShot3	Bool	%M100.6
7	Tag5	Bool	%M100.7
8	Tag6	Bool	%M101.0
9	1HZ_OneShot4	Bool	%M101.1
10	Tag7	Bool	%M101.2
11	Tag8	Bool	%M101.3
12	op	Bool	%Q0.0
13	Clock_10Hz	Bool	%M0.0
14	Clock_5Hz	Bool	%M0.1
15	Clock_2.5Hz	Bool	%M0.2
16	Clock_2Hz	Bool	%M0.3
17	Clock_1.25Hz	Bool	%M0.4
18	Clock_1Hz	Bool	%M0.5
19	Clock_0.625Hz	Bool	%M0.6
20	Clock_0.5Hz	Bool	%M0.7
21	1HZ_OneShot1	Bool	%M100.0
22	op2	Bool	%Q0.1
23	op3	Bool	%Q0.2
24	1HZ_OneShot	Bool	%M101.4

Default tag table			
	Name	Data type	Address
21	1HZ_OneShot1	Bool	%M100.0
22	op2	Bool	%Q0.1
23	op3	Bool	%Q0.2
24	1HZ_OneShot	Bool	%M101.4
25	Clock_Byte	Byte	%M80
26	ip0	Bool	%I0.0
27	ip1	Bool	%I0.1
28	ip2	Bool	%I0.2
29	ip3	Bool	%I0.3
30	AI0	UInt	%IW64
31	AI1	UInt	%IW66
32	Motor Speed PWM	Word	%QW1000
33	Motor RUN	Bool	%I0.4
34	Motor PWM output	Bool	%Q1.1

Fig.17 – Default tag table

The PLC program is a good compromise to test the web program functionality. This covers variable changing dynamic data including analogue input and PWM for motor speed control.

Iwan Downs

Web program Structure

User files in TIA program contain the needed libraries and htm files to format and call data.

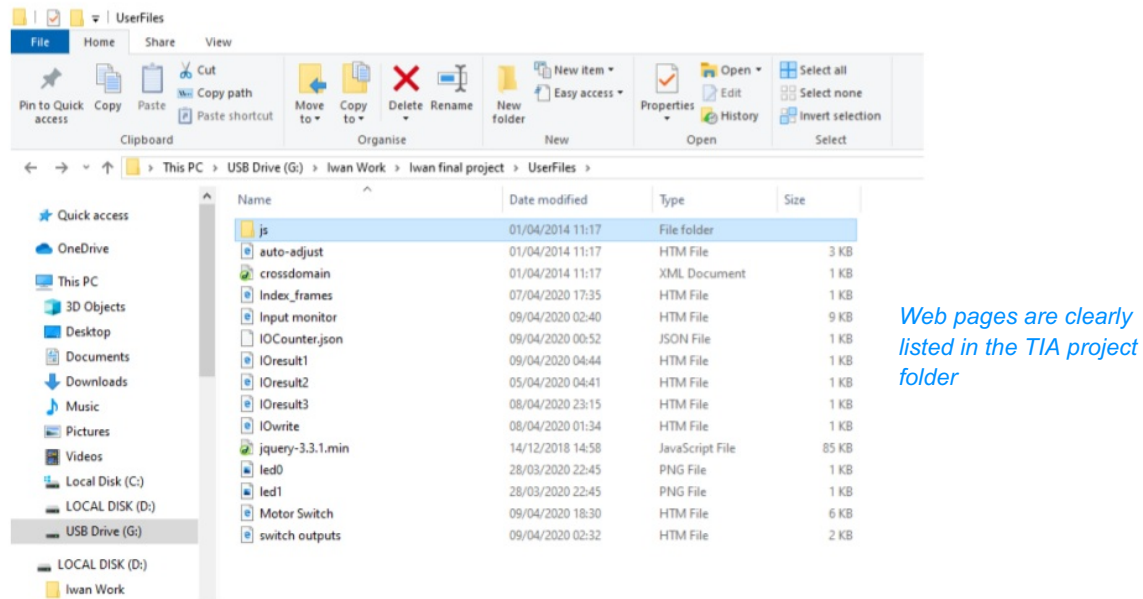


Fig.18 – User Files

These are .js library files downloaded from web site, the libraries are lightweight data-interchange formats. It is easy for humans to read and write. It is easy for machines to parse and generate.

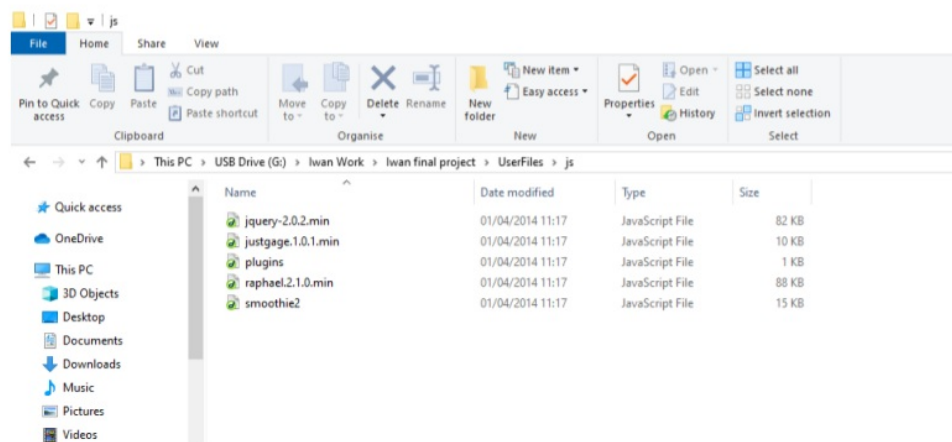


Fig.19 – Json Libraries

In Fig.20 the files for the HTML web page can be seen , they are used in the loading and running of the frames on the HMI.

Jquery is the library for the ajax and JavaScript functions and Justgage and Raphael are libraries for the gauges. The gauges are premade and just downloaded free of charge online.

The only part you have alter is the size and colour of whatever you want by altering the style css part of the program.

The most difficult part of the design is setting up the dynamic tag data implemented in the program.

Auto adjust.htm – handles the zoom in and out scaling (premade and downloaded)

Index_frames.htm – this handles the frame pages for the web page layout design.

BORDER="NO" FRAMESPACING="0" rows="89%,11%">

<frame noresize src="Input monitor.htm" frameborder="0" SCROLLING="NO">

<frame noresize src="switch outputs.htm" frameborder="0" SCROLLING="NO">

Pages are set to 89% and 11% for all web pages. The 2 pages here are:

Input monitor.htm

Switch outputs.htm

Motor switch.htm – contains the program for running the motor PWM via a text box and button on the HMI.

A gauge is implemented to indicate the analogue PWM value on screen.

Input monitor.htm – this handles the timers with LEDs and the input digital switches.

Switch outputs.htm – this handles the switching on / off of the outputs on the PLC at the bottom half of the screen

The LED .jpgs are the green/red images for the digital outputs.

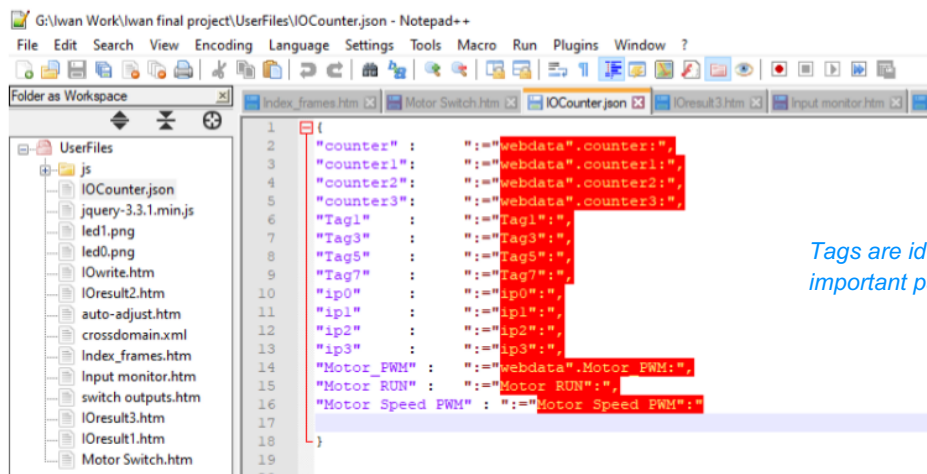
IOCounter.json, IOWrite.htm, IOresult2.htm, IOresult3.htm – these are the files where the tags are stored.

HTML code was used because it is the easiest language to learn and adapt with when building webpages. However, if we want to use images dynamically the page will have to have a refresh rate, probably of about 0.5 to 1 second. This is graphically very demanding and will cause a flicker on the screen, to avert this that is why JavaScript software is used.

The JavaScript software does not require a refresh as it uses a method called Ajax which is part of the jQuery library. Ajax enables the function to call a dynamic variable and monitor or read/write the variable using a let interval reload parameter which only reloads a select part of the page and not the whole page., but it can only call a single function result i.e. one tag value. Json is an extension on Ajax and uses the jQuery library. Json allows many function calls to many variables. However, the more variable that are called the slower the program. Furthermore, the PLC has a memory limit and can only have 15 data blocks allocated to the web page that's why for our images Jpegs aren't use but scalar vector graphics which are created in text editors like HTML and are animated variable graphics rather than solid image that are memory intensive. Using SVGs the data block level was kept to 7 blocks.

Ajax and JSON functionality is identified

IOCounter.json – this links the tags from PLC to the id's IN WEB PAGE



```

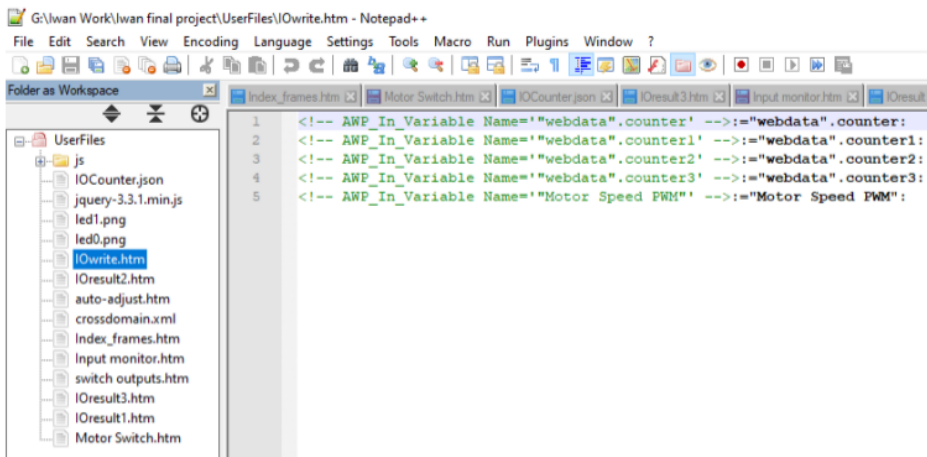
1 {
2   "counter" : "webdata.counter:",
3   "counter1" : "webdata.counter1:",
4   "counter2" : "webdata.counter2:",
5   "counter3" : "webdata.counter3:",
6   "Tag1" : "Tag1:",
7   "Tag3" : "Tag3:",
8   "Tag5" : "Tag5:",
9   "Tag7" : "Tag7:",
10  "ip0" : "ip0:",
11  "ip1" : "ip1:",
12  "ip2" : "ip2:",
13  "ip3" : "ip3:",
14  "Motor_PWM" : "webdata.Motor_PWM:",
15  "Motor RUN" : "Motor RUN:",
16  "Motor Speed PWM" : "Motor Speed PWM:"
17 }

```

Tags are identified and are an important part of the system.

Fig.20 – IOcounter.json

IOwrite.htm – the only tag used is the PWM. Sets tags for the PWM analogue control.



```

1 <!-- AWP_In_Variable Name="webdata.counter" -->:"webdata.counter:
2 <!-- AWP_In_Variable Name="webdata.counter1" -->:"webdata.counter1:
3 <!-- AWP_In_Variable Name="webdata.counter2" -->:"webdata.counter2:
4 <!-- AWP_In_Variable Name="webdata.counter3" -->:"webdata.counter3:
5 <!-- AWP_In_Variable Name="Motor Speed PWM" -->:"Motor Speed PWM:

```

Iwan Downs

Fig.21 – IOWrite.htm

IOresult2.htm – This has the tag for the pot analogue input

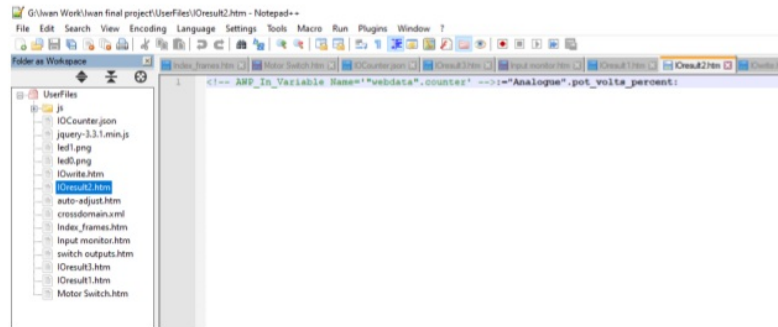


Fig.22 – IOresult2.htm

IOresult3.htm – This has the PWM tag for the analogue control.

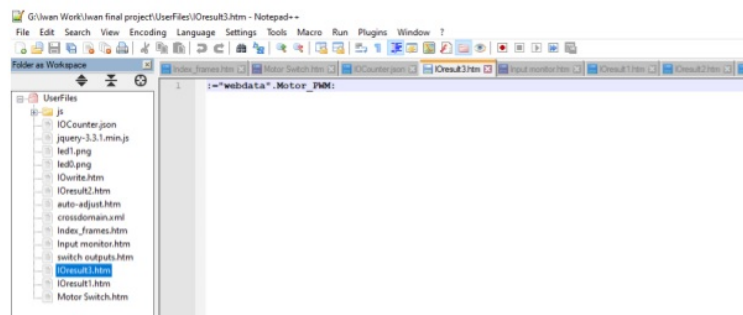


Fig.23 – IOresult3.htm

Tags are identified in the program and their purpose is explained.

Testing prototype designs:

Because of the nature of the project a lot of testing was required to get the project up and running and to work out the specifics of the program. Therefor the project was constructed in stages and prototype for functionality. Below are the stages of development when it came to figuring out how the program will work.

Prototype 1 - This implemented the text box and input button in ajax.



String1: := "webdata".counter:

String2: := "webdata".counter1:

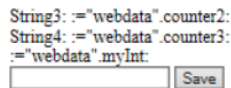


Fig.24 – Prototype 1

Prototype 2 - Multiple text boxes and input buttons using the JSON library functions.

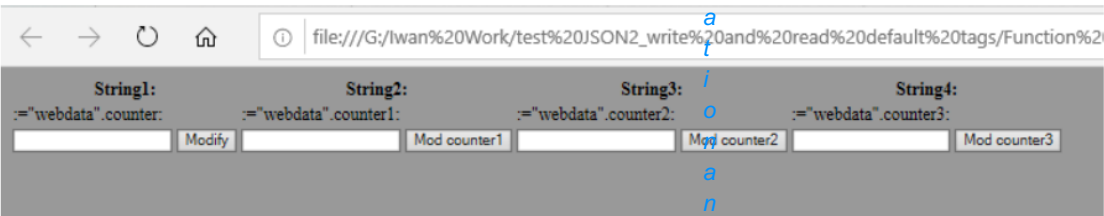
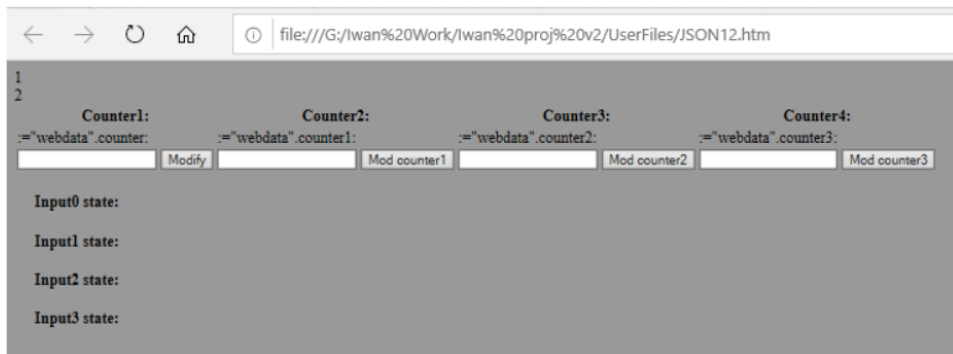


Fig.25 – Prototype 2

Prototype 3 - Reading input states from switches on PLC digital inputs and displaying the values with no images.



Good illustration of data entry development.

Fig.26 – Prototype 3

Prototype 4 - This has the dynamic image functions for the counter binary state values and input switches from plc. On and off conditions are displayed.



Dynamic values monitoring development is clearly shown

Fig.27 – Prototype 4

Prototype 5 - This has the dropdown menu navigation for linking the web pages dynamically

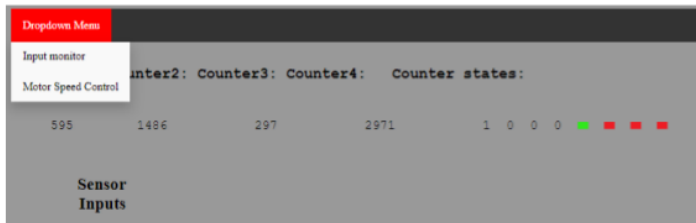


Fig.28 – Prototype 5

Prototype 6 - This has the write function switches for switching PLC outputs on and off



Fig.29 – Prototype 6

Prototype 7 - The gauge implemented for the dynamic analogue input. A POT was used with the PLC analogue input.

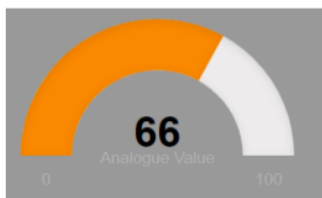
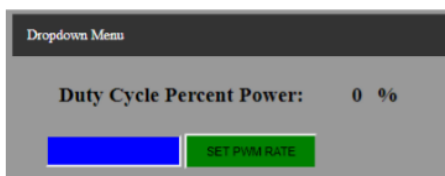


Fig.30 – Prototype 7

Prototype 8 - This implements the dynamic control for setting and reading the PWM power control of the motor speed.



Iwan Downs

Fig.31 – Prototype 8

Prototype 9 - The gauge for speed indication and led for power on / off indication are implemented.

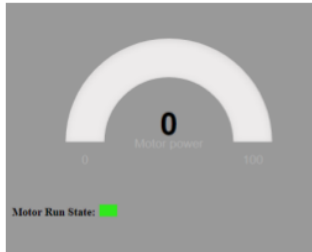


Fig.32 – Prototype 9

There is little maintenance required in this system it is designed to run in parallel to the current PLC system therefore there are no problems with sustainability. If need be the program can be changed at a later date to accommodate more diagnostic screens, this would be easy to do after the bulk of the work has already been in the initial start-up.

Good explanation and images that illustrate the development of the prototypes leading up to the final solution implementation.

6. Testing and Results

In this section we will be looking at the testing methodology to ensure that the project is fit for purpose. Each individual aspect of the project will be tested individually with supporting evidence.

The system was set up as seen in Fig.33. The Laptop accessed the web server via the Sky router and the motor was routed through the analogue output with a variable resistor routed to the analogue input.

*This
is the
digital
output*

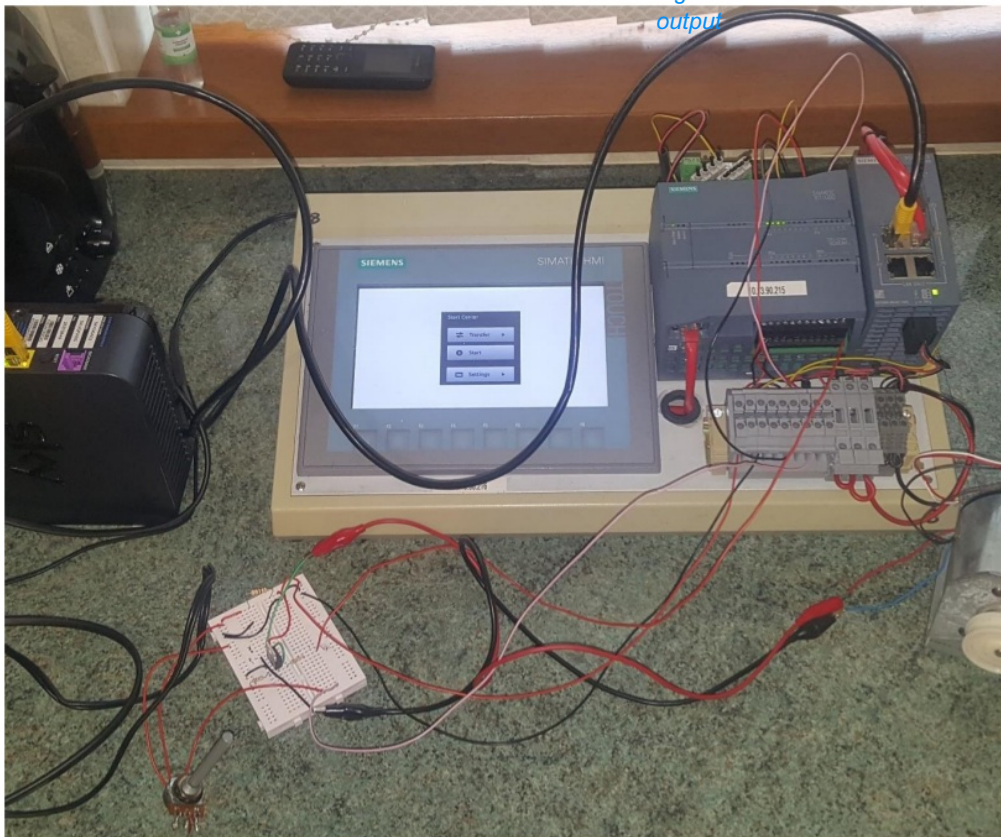


Fig.32 – PLC Testing Setup

Test digital outputs switches:



The first test was the digital outputs, when the button was pressed on the web page the LED indicators changed on the PLC in Fig.33.



Fig.33 – PLC Testing Digital Outputs

Then the counter states were tested, below in Fig.34 it can be seen at different stage the LEDs changed states as the counter ran.

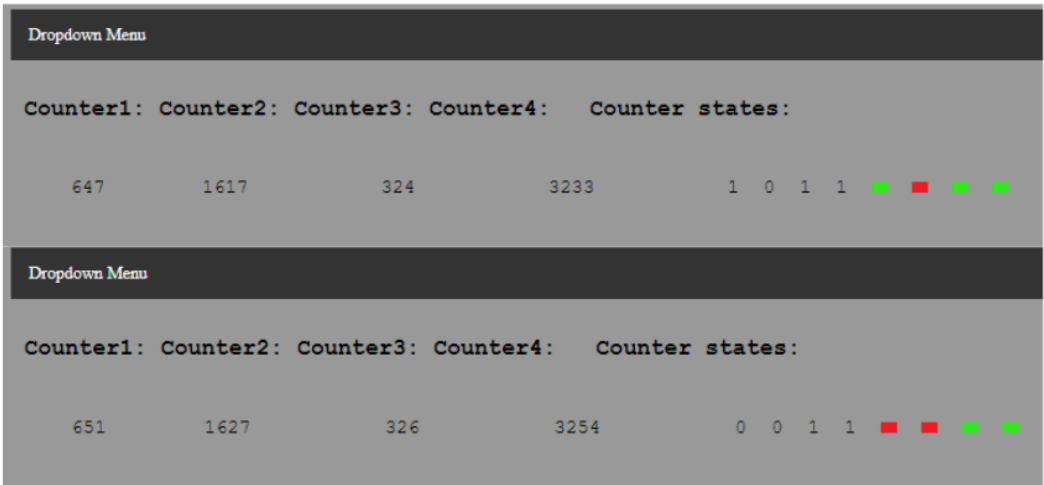
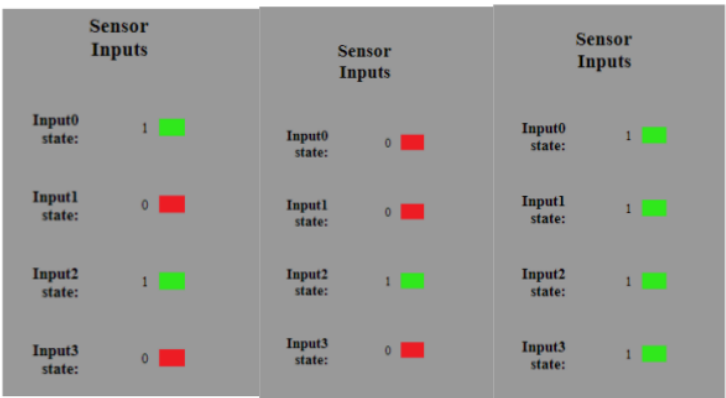


Fig.34 – PLC Testing Counter States

Good test for fast changing dynamic data.

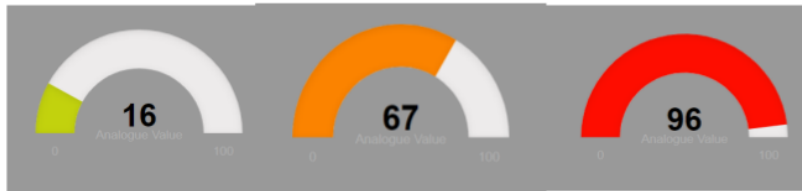
The next test was the digital inputs test when the switches were changed the LEDs changed on the webpage as seen in Fig,35.



Input tests are good and clearly show the set and clear states.

Fig.35 – PLC Testing Digital inputs.

The next test was the analogue input gauge. When the potentiometer was altered the scaled values changed as seen below in the SVG indicator.



Gauge values look scaled correctly and showing low medium and high values.

Fig.36 – PLC Testing Analogue Input.

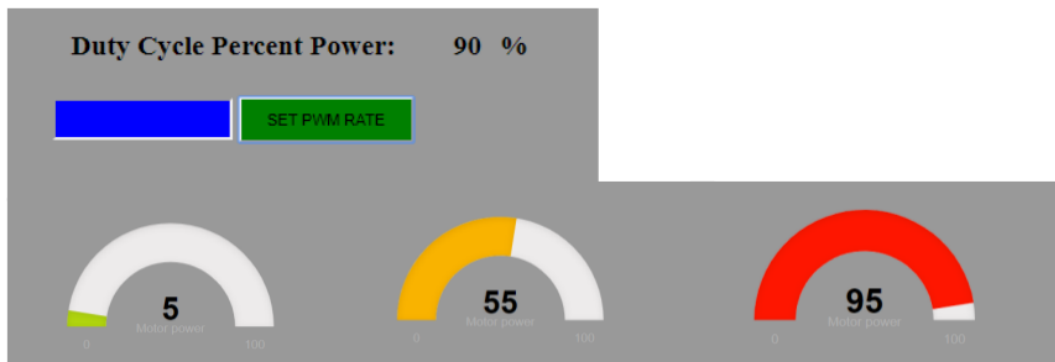
The final test was the Motor power on off state test and the PWM control for the analogue output as can be seen in Fig.37 and Fig.38.

Fig.37 Motor off /Motor on states.



Motor state tests are good

Fig.38 - Test PWM set values from web page.



The PWM control was tested at varying duty cycles, at 5% duty cycle power, 55% duty cycle power and at 95% duty cycle power. The gauge worked as intended and the motor reacted accordingly unfortunately it is impossible to get graphic evidence of the motor running.

Overall, the project can be deemed a success, both analogue input/output tests worked as well as the digital input/output tests. The web page communicated freely with the PLC with no issues regarding lag or stuttering.

7. Discussion, Conclusions and Recommendations

In regard to the comments and results from task 6 and the specification from task 3 it can be state that the project was a success. The project is only a proof of concept and the knowledge learnt can be applied to larger systems. The project was completed in the allotted time and there was no need to go over budget.

There were several issues which had to be overcome during the project that served as useful learning experiences. Such as the several security issue that had to be overcome. Initially the PLC used had firmware lower than version 3 the problem with this is that web servers below version 3 firmware were for read only purposes due to security. Version 3 cannot be upgraded locally; this needs to be done with Siemens and is time consuming. Whereas version 4 onwards can be upgraded locally, to remedy this a PLC with firmware V3 was used.

*Do you mean
V4*

Furthermore, the original router also had security issues with communicating with the laptop and PLC, the router had to be changed to a Sky router as the original router did not possess an appropriate IP range.

When it came to PLC web server, it does accept and cannot run .js file extensions. The way around this was to embed all javascript software in the .htm file. The tag values from data blocks are different to default tag tables when declaring for the web page id's. Also, the javascript gauges and graphs are premanufactured for use with dynamic systems such as PLC's and were downloaded and used in the project and are not original work but open source some being free and others costing.

These gauges and graphs are not images, they are SVG's [Scalor Vector Graphics] as mentioned earlier and allowed us to keep the memory limit down as they are only coded lines and dots which make up an image but have a fraction of the memory cost. These are ideal for this type of system as it speeds up the running of the program. The dynamics i.e. real time component values are embedded in these SVG's and then implemented in the web pages.

*Good explanation for the reason
for using SVG's for the graphics.*

8.Reference list and Bibliography

Freeman, J. (2019, October 25). *What is JSON? A better format for data exchange*. Retrieved from Inforworld: <https://www.inforworld.com/article/3222851/what-is-json-a-better-format-for-data-exchange.html>

I-Scoop. (2019). Industry 4.0: the fourth industrial revolution – guide to Industrie 4.0. *i-SCOOP / Digital business and transformation hub*.

Jager, T. (2013, September 7). *Siemens S7-1200 Web Server Tutorial*. Retrieved from DMC: <https://www.dmcinfo.com/latest-thinking/blog/id/8567/siemens-s7-1200-web-server-tutorial--from-getting-started-to-html5-user-defined-pages>

MDN WebDocs. (2020, March 19). *HTML basics*. Retrieved from MDN WebDocs: https://developer.mozilla.org/en-US/docs/Learn/Getting_started_with_the_web/HTML_basics

PI News. (2016). IO-Link, Industrie 4.0, and Industrial Internet of Things. *ProfineWS*.

Siemens. (2020, April 16). *Creating and using user-defined web pages on S7-1200 / S7-1500*. Retrieved from Siemens: Creating and using user-defined web pages on S7-1200 / S7-1500

TutorialsPoint. (2020, February 2). *JSON with Ajax*. Retrieved from TutorialsPoint: https://www.tutorialspoint.com/json/json_ajax_example.htm

Go
od
use
of
source

Iwan Downs Project Report

GRADEMARK REPORT

FINAL GRADE

GENERAL COMMENTS

Instructor

64/100

PAGE 1

Text Comment. The contents should contain sub divisions to show more detail

PAGE 2

Text Comment. Good point about IOT.

PAGE 3

Text Comment. some grammatical errors

Text Comment. Good research carried out and the explanations are clear.

PAGE 4

Text Comment. Research is good with relevant sources cited but there some grammatical errors

Text Comment. A reasonable budget since the software is open source

PAGE 5

Text Comment. Good breakdown of costs

Text Comment. Good point made about environmental impact

PAGE 6

Text Comment. Good use of Gantt chart but it is not clear when the actual activities took place. It seems incomplete.

Text Comment. There needs to be more details and explanation of how a Siemens SCADA .ie Wincc is a reasonable alternative and how it would work.

Text Comment. Good explanation and block diagram which clearly shows how the system is connected.

Text Comment. The 7 layer OSI relevance is explained appropriately for this project.

Text Comment. OSI devices are identified for use in this project and are part of the 7 layer model.

Text Comment. Good illustration of PLC program tree

Text Comment. Good image of web server activation inside PLC TIA application.

Text Comment. The PLC program is a good compromise to test the web program functionality. This covers variable changing dynamic data including analogue input and PWM for motor speed control.

PAGE 23

Text Comment. Web pages are clearly listed in the TIA project folder

PAGE 24

Text Comment. Clear explanation of what the files are for.

PAGE 25

Text Comment. Ajax and JSON functionality is identified

Text Comment. Tags are identified and are an important part of the system.

PAGE 26

Text Comment. Tags are identified in the program and their purpose is explained.

PAGE 27

Text Comment. Good explanation and start of investigation of functions

PAGE 28

Text Comment. Good illustration of data entry development.

Text Comment. Dynamic values monitoring development is clearly shown

PAGE 29

PAGE 30

Text Comment. Good explanation and images that illustrate the development of the prototypes leading up to the final solution implementation.

PAGE 31

Text Comment. This is the digital output

PAGE 32

Text Comment. Tests are good and show the outputs set and clear

PAGE 33

Text Comment. Good test for fast changing dynamic data.

Text Comment. Input tests are good and clearly show the set and clear states.

PAGE 34

Text Comment. Gauge values look scaled correctly and showing low medium and high values.

Text Comment. Motor state tests are good

Text Comment. Motor control with PWM duty cycle is demonstrated with low, medium and high values which illustrates correct operation.

PAGE 35

Text Comment. Do you mean V4

Text Comment. Good explanation for the reason for using SVG's for the graphics.

PAGE 36

Text Comment. Good use of sources

GRADING FORM: CSG-RUBIC

IWAN COSTELLODOWNS

0

RESEARCH-INFORMED LITERATURE



The research carried out is of a good quality and appropriate number of relevant sources used. 6.5/10
Good relevant sources used. 6.5/10

13/20

KNOWLEDGE AND UNDERSTANDING



Specification is clear with budget and good use of block diagram. 6/10 The solutions considered are the final solution which is good but the alternative should have been researched further with relevant examples. 5/10

11/20

ANALYSIS



Testing and results are good and clearly explained. There is sufficient detail in this section. 7.5/10
Conclusion and recommendations are good and make a relevant point of Industry 4.0. 7.5/10

15/20

PRACTICAL APPLICATION AND DEP.



Planning with the use of a Gantt chart is clear and the project seems to have run to the plan. 3/5 Final solution considered is good but the alternative is limited and a third solution should have been researched. There are many forms of SCADA and another application should have been researched to supplement this section. 5/10 Implementation is explained very well with supporting images as evidence. 7/10

15/25

SKILLS FOR PROFESSIONAL PRAC.



The quality of the report is good although there are some minor grammatical errors. 11/15

10/15