

# Improvement of Monitoring and Control Capabilities of Environmental Instrumentation

B.Sc. (Honours) in Instrument Engineering

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## Introduction

### Project Background

- Conductivity of water is the ability of water to pass electrical current, it is a measure of the amount of total dissolved solids present in water and is an important factor in water quality.
- Water can act as either a conductor or insulator depending on the ions present in the water, Conductivity measurements are among the most common measurements taken when attempting to determine the quality of water.



Fig 1.0 Waste water treatment plant

### Project Outline

- Establish Instrumentation and Control Software and Hardware requirements for Monitoring and Control of Conductivity levels in water.
- Demonstrate the local and remote capabilities for communication.
- Design the process layout and associated alarms and signals.
- Design DeltaV system with relevant I/O, control module, graphical displays and control panel.
- Evaluate system performance and improvements.



Fig 1.1 Emerson DeltaV

## Design and Experimental method

### Experiment

- Conduct an experiment that investigates the effect that temperature and dissolved solids has on water conductivity.
- A 9v circuit was constructed incorporating an LED light strip to examine the effects temperature and dissolved solids has on water.
- Three samples of room temp, cooled and boiled water used.
- Salt added to each sample to investigate dissolved solids effects on conductivity.



Fig 1.2 9V circuit submerged in water samples

### Design

- Schematic for process was designed with all relevant valves and filters.
- Design implemented into DeltaV graphics along with the construction of the necessary I/O Function Block Diagram and an accompanying Sequential Function Chart to initiate the automated steps of the process.
- A control panel was also constructed in DeltaV with lamps and push buttons to allow user feedback of the process state.

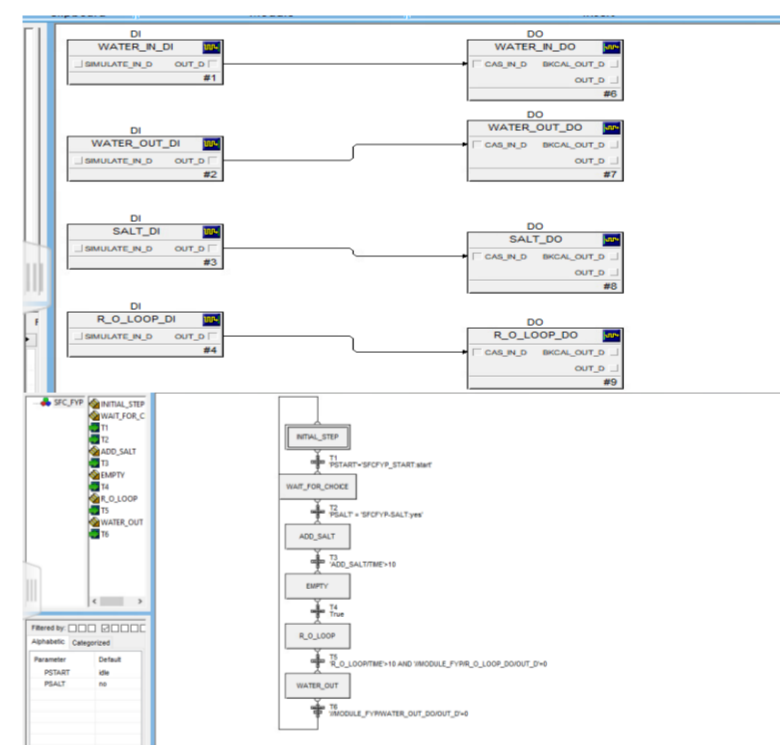


Fig 1.3 DeltaV I/O, SFC and Graphics

## Additional Information

### Limitations

- Due to covid limitations existed in the project, but the project was adapted to appropriately to ensure successful completion.
- Some of the limitations encountered where not being able to gain access to equipment and construct certain aspects of the project but overcame by simulating a real world situation.
- Communication to the server that hosted the DeltaV suite was not always reliable but again management of time appropriately overcame these difficulties.

### Conclusion

- Many contributing factors determine the quality of water such as temperature, dissolved solid content, PH etc.
- Remote monitoring capabilities of waste water treatment plants is crucial to there upkeep.
- Using the DeltaV suite, these remote monitoring systems can be incorporated quite easily and offered a robust and simple solution, with the use of local control panels and PLC's.

### Future work

- There is many areas where future work could be done on this project to increase the advantages of doing it.
- Interaction with a real life rig and instrumentation with a control panel and physical PLC's would be beneficial so that more functionality could be introduced to the system.
- A real life rig would offered more opportunities to examine results and analyse results so that changes could be made to the process to improve it. And would also showcase the capabilities of remote monitoring and control.
- This process would also benefit from adding in temperature and PH monitoring and control would also improve the processes ability to treat waste water.

## References

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