Maestría en Ingeniería en Automatización de Procesos Industriales

Title

Design and construction of a system of automated laboratory-scale bioreactor

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1. Introduction

Knowing environmental information or some device is increasingly useful for their great impact and is required primarily for controlled environments or devices whose operation should be monitored.

One of many areas of application where is required the monitoring and control of signals, is the bioprocesses, due to the need to provide appropriate culture medium conditions.

Monitoring temperature, pH, dissolved oxygen and controller the agitation bioreactor is indispensable to carry out cell metabolism and reproduction, providing a suitable playback medium.

2. Objectives

2.1. General objective

Automating a system of bioreactors laboratory scale for measurement, acquisition and graphical display of process variables and control agitation and pH in the medium.

2.2. Specific objectives

- Design and construction of a laboratory-scale bioreactor system.
- Implement a system control motor speed for agitation of a bioreactor and control of pH with peristaltic pumps.To assess at least three machine learning algorithms for people identification.
- Implement temperature sensors, oxygen dissolved and pH for data acquisition and monitoring via LabView.

3. Method

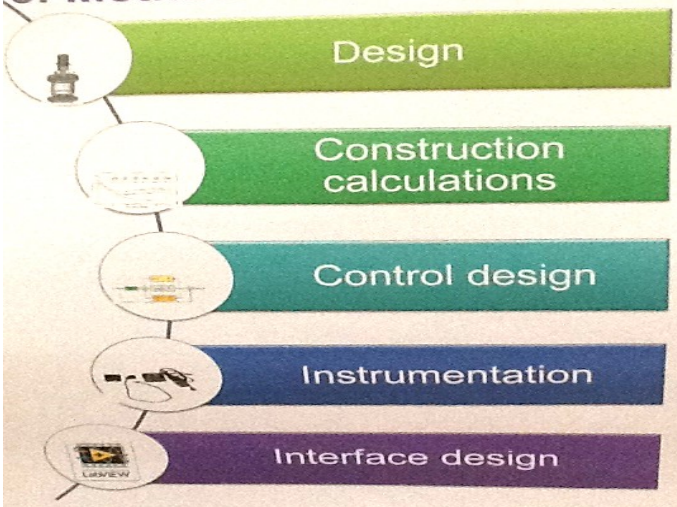

Figure 1. Methodology utilized in this research.

3.1 Bioreactor design structure

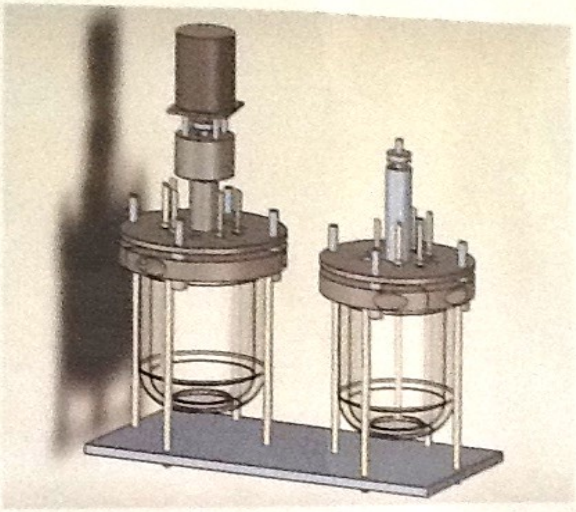

Figure 1. Bioreactor structure.

3.2 Power Calculation Motor

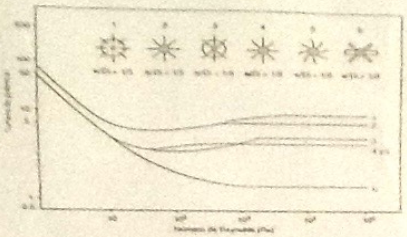

Figure 2. Power number

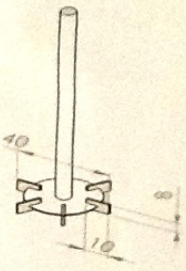

Figure 3. Propeller

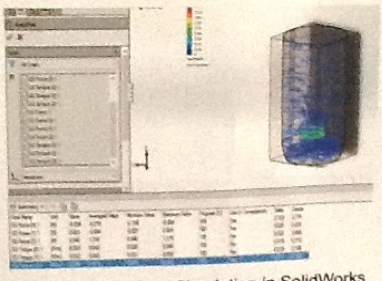

Figure 4. Simulation in SolidWorks

The calculation power required, carried out with support from Figure 3, at a maximum speed of 1000 rpm is 0.01153 HP, these results were compared to a simulation carried out in the SolidWorks software, where similar results are shown of 0.0119 HP.

3.3 Selection of electronic devices

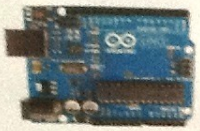

Figure 5. Arduino uno

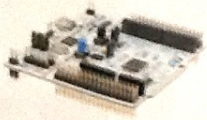

Figure 6. Nucleo-F446RE

Figure 7. Thermocouple

Figure 8. pH Sensor

Figure 9. Dissolved oxygen sensor

Figure 10. Driver motor

Figure 11. Peristaltic Pump.

Figure 12. DC motor 30E20

4. Results

According to the requirements of the structure the drawings are designed to be machined and temperature sensors and pH were instrumented.

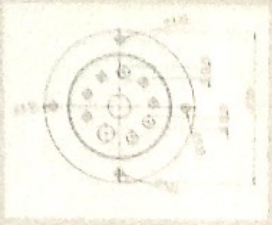

Figure 13. Bioreactor top

Figure 14. Support Bioreactor

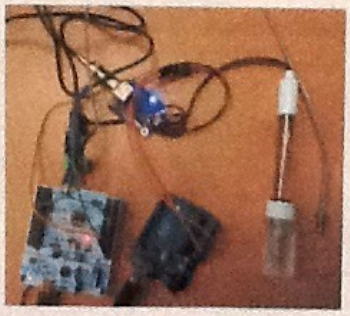

Figure 15 Implementing sensors

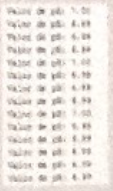

Figure 16. It shows the measurement of pH buffer 4

Figure 17. It shows the measurement of pH buffer 7

Figure 18. It shows the measurement of temperature.

5. Conclusion

According to the preliminary results, we can conclude that the selected sensors and made programming are stable, since the pH sensor shows a margin of error between ± 0.1 pH and temperature sensor has a variation of ± 0.5 ° C.

It was proposed an economic design structure the bioreactor by placing a single motor for stirring two bioreactors

Acknowledgements

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