DAQ for Dogs

DESIGN DOCUMENT

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List of figures/tables/symbols/definitions (This should be the similar to the project plan)

1 Introduction

1.1 Acknowledgement

Thanks to support from our clients Simon Laflamme and Austin Downey, we believe that our project will be successful in our given time frame. While providing our team with technical knowledge and funding, we are also being given the hardware to create our prototype. The culmination of these contributions saves us time and money, and allows us the freedom to work on the project with minimal limitations.

1.2 Problem and Project Statement

Our client wants to be able to have a better understanding of the stitches that are done on dogs during surgery. To do so he is in need of a device that is able to record the strain on the skin and the stitches while the animal does his daily activities.

The solution that our group decided to implement is to use a device based on a sensor which would collect data of the strain on the dog's skin and connect it to a electronic device that is able to record this data throughout the day. This electronic device or DAQ (data acquisition) device will be attached to the dog's body and it will carry it around.

The final goal of this project is to help our client to understand the variations of strain applied on the dog's skin in order to help veterinarians design and perform better surgeries on these animals. This could help dogs to have a faster recovery time and possible decrease the costs of post-surgery maintenance.

1.3 Operational Environment

Our final product is intended to be attached to a dog. Taking this in consideration, our device needs to be protected against potential impacts and scratches done by the dog. Another possible feature that we it needs to have it to be able to be resistant against the outdoor environments, such as been able to resist to water and dust.

1.4 Intended Users and Uses

The device will the operated on a dog, however the DAQ could be operated by one possible customer: veterinarian.

1.5 Assumptions and Limitations

List of assumptions:

- The product will only be used by our client
- The sensor will be provided by the client
- The DAQ only has to collect resistance data from one sensor

List of limitations:

- The final product will be small enough to fit in a dog's collar
- the device should have a personalized app
- the DAQ has to have a 16 bit ADC
- minimum clock speed of 100Hz
- the range of resistance error should be 20%.

1.6 Expected End Product and Deliverables

The project will have two different parts as deliverables, the electronic device (DAQ) and the software (app). The electronic device should come with a manual that explains all the different parts of the circuit. The first part of the user manual should have instructions on how to operate it and show all the features that comes with the device, the second part of the manual should contain all the technical descriptions on the circuits and the data sheets of all the microchips.

The app should also come with a user manual that explains all the features and how to operate it.

2. Specifications and Analysis

2.1 Proposed Design

Our group decided to solve the problem by designing a DAQ that can read and store data from the sensor as well as designing an app to let the user manipulate and visualize the data.

So far, we have tested our sensors for data collecting. We have been able to translate this collected data onto our Arduino board and then pass the said collected data using a wifi module onto our desktop. Simultaneously we have made database

2.2 Design Analysis

So far we have collected all the hardware necessary to build our working prototype. The hardware we have collected are the sensors and an arduino uno with a micro sd card storage. Beyond collecting the hardware, we have also started testing the sensor. By simply hooking up an ohm-meter to the sensor and varying the length of the sensor we are able to determine the resistance at different points. We have determined during our testing that any kind of movement on the sensor will change the resistance. This means that not only horizontal stretching but any twisting movement in other directions also has an effect. This means that we will need to figure out if this kind of data will be wanted or if we need to filter it out. We are now working on the arduino and learning how to program various aspects of it. This will be necessary for the success of our project as the arduino will be the device collecting all the data. Some weaknesses we have discovered is that none of us have any experience with data acquisition or arduino programming. That is why this step is taking so much time for our team.

– Discuss what you did so far

– Did it work? Why or why not?

– What are your observations, thoughts, and ideas to modify or continue?

– If you have key results they may be included here or in the separate “Results” section

-Highlight the **strengths, weakness**, and your observations made on the proposed solution.

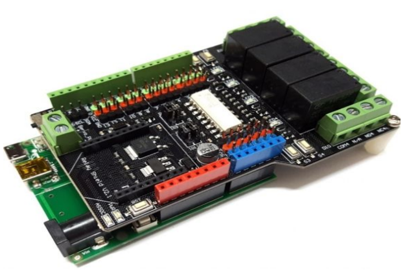
3 Testing and Implementation

3.1 Interface Specifications

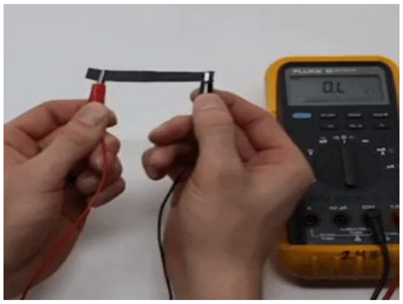
We have to understand basic principles of DAQ and how it interfaces with LABVIEW that is software we are using for this project. The titanium-dioxide sensor is installed on dog’s wounded skin and then the dog is chemically or physically restrained for surgery. When the wound starts getting well by stitching, the wound range will be narrower, so the titanium-dioxide sensor(stretch sensor) will measure its changes of capacitance. These records are transmitted to the DAQ device to convert to analogue signal to digital signal to analyze the data on user’s computer. We are going to use LabVIEW program which is widely used for DAQ system. Through this program, we will be able to see the changes of dog’s depth of wound.

3.2 Hardware and software

<Hardware>



DAQ device: DAQ(data acquisition system) is a kind of system that acquires data and stores it. For example, DAQ device analyzes physical parameters as digital signals such as light, temperature, pressure, and so on. DAQ system consists of a sensor, signal processing device, and ADC(analogue to digital converter). The sensor will change the physical parameters to electric signals for ADC. In terms of ADC function, most of DAQ modules has an input as ADC, and an output as DAC. We need to focus on those process. Briefly, analogue signal firstly goes through sampling process. Sampling rate has immediate and importance influence on quality of ADC. After sampling, the signal will be changed to digital code, and it is called ADC. The important thing in this process is resolution from the number of bit. High resolution makes many number of detailed voltage ranges.



Titanium-dioxide sensor: It is a kind of sensor that can measure stretch, and it is essentially a flexible capacitor. When the sensor deforms due to stretching or squeezing, its capacitance value is changed. Our project purpose is measuring the movement of the stitches on dog's skin. When the dog's open wound is stitched, this stretch sensor records the wound range. The sensor sends capacitance to the DAQ device and translates the data to give a user highly precise information about what the sensor measures.

<Software>

LabVIEW: This program is what we are going to use for this project. The reason why we chose this program is that LabVIEW is widely used for DAQ system and it is compatible with most of DAQ devices. We can acquire and analyze the data from DAQ device by computer. Other programming systems use text-based programming language, but LabVIEW uses block diagrams like simulink in MATLAB. This is also called "graphical programming" or simply "G language". In addition, LabVIEW contains debugging tools, so we can observe data flow dynamically. We can also do numerical calculation with this program.

3.3 Functional Testing

As our project is only collecting resistance data we can simply test our results with the ohm-meter value that corresponds with the same setting. If this value is within the error allowed then we will know our collection system is working properly. Once this step is done, we will be able to take further steps into our project as well as the app development.

3.4 Non-Functional Testing

This will be done in the second semester. We will be able to actually apply it to a dog and see the compatibility in the real world.

3.5 Process

The hardware we are using is Arduino and a titanium-dioxide sensor. The Arduino can be easily be tested setting each channel to ground and power in order to read the output in a monitor. To do this, you just need to connect a wire to the input and power connectors of the Arduino board.

LabVIEW can be tested by simply obtaining acquiring and analyzing the data from any DAQ.

– Explain how each method indicated in Section 2 was tested

– Flow diagram of the process if applicable (should be for most projects)

3.6 Results

Arduino

- –

Titanium-dioxide sensor

- – Stretching/squeezing sensor and observed it's capacitance confirms that the sensor does do what it is intended to do which is sense the change in elasticity which will in turn measure the movement on a dog

– List and explain any and all results obtained so far during the testing phase

- – Include failures and successes
- – Explain what you learned and how you are planning to change it as you progress with your project
- – If you are including figures, please include captions and cite it in the text

  • This part will likely need to be refined in your 492 semester where the majority of the implementation and testing work will take place

-**Modeling and Simulation**: This could be logic analyzation, waveform outputs, block testing. 3D model renders, modeling graphs.

-List the **implementation Issues and Challenges**.

4 Closing Material

4.1 Conclusion

So far we have tested our device and have collected data in an ideal as well as a non-idea l(external disturbance) based environment. Our device needs to be keeping accuracy in case of external disturbances and to do so it must detect such conditions. Once these conditions are detected the data collected for that period would be termed as "corrupt" data and it would not be used in data analysis. Alternatively, we could have included every value collected by our device in our computations but we observed a very high fluctuation which would not give us accurate results. Thus we chose to go with the method involving cutting out bad data.

Summarize the work you have done so far. Briefly reiterate your goals. Then, re-iterate the best plan of action (or solution) to achieving your goals and indicate why this surpasses all other possible solutions tested.

4.2 References

This will likely be different than in project plan, since these will be technical references versus related work / market survey references. Do professional citation style(ex. IEEE).

4.3 Appendices

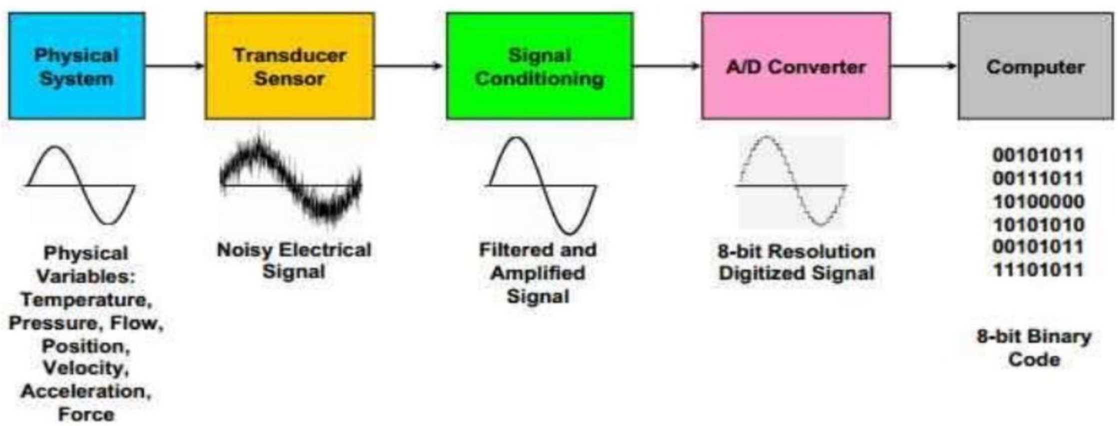


Figure 1. DAQ Module

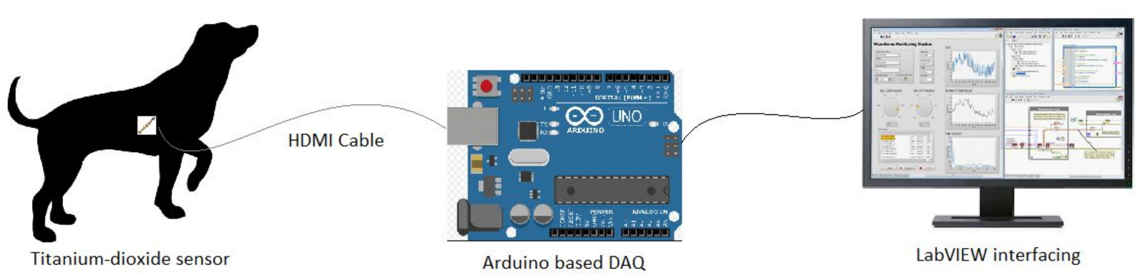


Figure 2. Interface between titanium-dioxide sensor, arduino based DAQ, and LabVIEW