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List of Figures

Include a **LIST** of all figures used. Be sure images throughout paper have same indexing.

*(example)*Figure 1: Proposed Design Diagram

List of Tables

*ex.* Table 1: Timeline of proposed work schedules for the Spring semester.

List of Symbols

N/A

List of Definitions

DAQ: Data Acquisition

# 

# 1 Introductory Material

## 1.1 Acknowledgement

Our client, Simon Laflamme, as well as Austin Downey will be our main sources of technical knowledge and funding for this project. Having vast background knowledge on the project and past experience, their input will be vital to the success of this project.

## 1.2 Problem Statement

Our client is currently developing a biosensor that can be used on live animals to detect strain data on skin. The specific location where the sensor will be placed is on stitches made on dogs. This will allow vets and medical personnel to be able to collect data regarding movements made by the dog and the resulting effect on the stitches.

Our task for this project is develop a data acquisition system that will be able to take the input from the sensor, convert and display the data so that is can be used by vets. Since the sensor will be on the dog, another important aspect of our project is to make our DAQ small enough to also be placed on the dog without causing discomfort. Another potential goal for this project, is to build an app that can display the data for the purpose of adding more functionality to our project.

## 1.3 Operating Environment

Our DAQ has the versatility to be used with any wired resistance sensor, however for our purpose it will be placed on a dog. For this reason, it will need to be very sturdy. As most pets are very active and reckless at times, we will need to build a case of some sort to house our DAQ to keep the components safe. We were also told by our client that our dog would most likely be wearing a safety cone as well as a harness. This makes our job a little bit simpler as we have a location to store it as well as being able to avoid the dog’s mouth from damaging our device.

## 1.4 Intended Users and Intended Uses (two paragraph +)

The intended users of this project will mainly be veterinarians and our client. The data that we will be recording is the effects of various kinds of movement on stitches. This can be used for medical research on stitches as well as administering more effective stitches. This is the main purpose of our project, but there can also be other uses since our final product will be so versatile.

Since we are building a portable DAQ with the capability to take in data from a resistance sensor, this can be used by anyone that is working with a resistance sensor. Our DAQ is also a small and lightweight DAQ making it a better option for users than a bigger and bulkier one.

## 1.5 Assumptions and Limitations

Assumptions

1. Our client has told us that any sensor needed will be provided and that we do not need to develop anything besides the DAQ
2. We are only reading data from one sensor

Limitations

1. The overall size and weight must be minimal to not discomfort the dog
2. We have been provided a $200 budget for this project.
3. Measurement precision must be within %20 error of the reading

## 1.6 Expected End Product and Other Deliverables

1. DAQ prototype (Spring 2018) -

* Working model on Arduino provided by client
  + Be able to collect data from sensor
  + Filter the data
  + plot final data

2. DAQ Final Product (Fall 2018) -

* Design and print own circuit board
  + Small and Lightweight
* Be able to the same as the prototype

3. DAQ App (Fall 2018) -

* Purpose: Add more functionality to our project
* Potential Uses:
  + Display Data
  + Turn on/off DAQ
  + Warning notification
    - battery power is low
    - resistance data is high(damage to stitches)

# 2 Proposed Approach and Statement of Work

## 2.1 Objective of the Task

Through this project we propose to have a functioning DAQ system which is able to collect the stress exerted on the stitches which would be there on dogs. Our system would be a portable data collecting device capable of storing the stitch-stress data on the storage device of a circuit board. Overtime as the dog wound begins to heal we would expect the stress on the wound to reduce. Otherwise, our system would detect anything unexpected and alert the owner. In addition, we would be collecting data which would be used in understanding the how the stitch stress affects the healing process and whether there can be any changes made in the tightness of the stitch while stitching dog wounds.

## 2.2 Functional Requirements

1. Data acquisition and parsing to circuit board
2. Data storing
3. Computations on the acquired data
4. Parsing data/computed data from circuit board to a computer server
5. Making an application using server data
6. Application for non-technical audiences

## 2.3 Constraints Considerations

Our client has mentioned the following restraints -:

1. We need to be collecting data using USB into an SD card
2. The resistance data can have an error upto 20%
3. Our data should be collected with a frequency of 100Hz
4. Each data segment which is collected should be 16bits
5. There needs to be ON/OFF measures
6. It should be a dog collar.

## 2.4 Previous Work And Literature

We could not find a product which is similar to the design our client expects us to make. However, in the market there are many DAQ systems which serve different purposes. Fundamentally, we would collect data and do computations as per our client’s instructions. The design of the DAQ system is also going to be original. In the market there are DAQ systems for collecting soil humidity, water temperature etc. We would be studying the designs of these DAQ systems to get an understanding of the data acquisition processes deployed in this system. Secondly, we would be making the raw data which is collected readable after performing calculations on it. This would be presented in the form of an application. There exist many applications which similarly perform tasks as the one we propose to have.

## 2.5 Proposed Design

Our ultimate purpose of this project is to make small, lightweight, and low-cost data acquisition system. DAQ system is composed of a programmable microcontroller which is easily programmed based on Arduino. We are going to use “LabVIEW” for the data acquisition because it can be used for personal computer-based data acquisition device in various ways depending on user’s experiment objectives. We are measuring tightness of the stitch while stitching dog wounds. There is a sensor measuring it and we will use operational amplifier to reduce noise. When we receive signals from the sensor, the tightness is recorded in numerical values. We need an A/D converter(ADC) which converts analog to digital. For ADC, we will probably use national instrument’s product because it is compatible to “LabVIEW”. This is our approximate process for the project, but it will be modified and improved by frequent meetings with our teammates and clients.

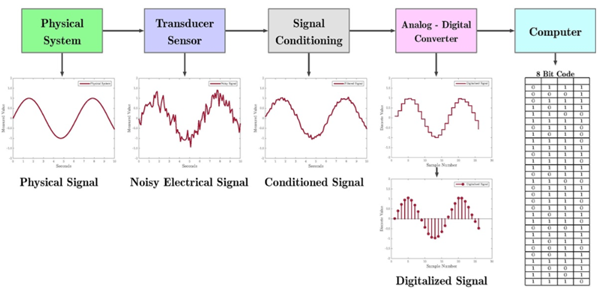
## 2.6 Technology Considerations

The DAQ we will make is a miniature and low-cost. The system maintains maximum flexibility while remaining as small and lightweight as possible. But, as it is made in small size, it is easy to be broken by active dog’s movements. Therefore, we will think about something that can protect the device.

## 2.7 Safety Considerations

As this is an electronic device, we should concern about electric shock. The purpose of our project is caring dog’s health care, therefore we should put a strong emphasis on dog’s safety. For example, if dogs bit off the device, there will be not only safety problems, but also damages on the device. We should more focus on this kind of situation.

## 2.8 Task Approach



First of all, we need to deeply understand how DAQ system works. A sensor(transducer) converts physical phenomenon, which is tightness of the stitch while stitching dog wounds into a measurable electrical signal. Depending on the type of sensor, its electrical output can be a voltage, current, or resistance that varies over time. DAQ hardware acts as the interface between computer and signals and then it digitizes incoming analog signals. After that, the computer can interpret them. This converting system is called ADC(Analog to Digital Converter). Finally, we install a software for programming to control the operation of the DAQ device. It is used for processing, visualizing, and storing measurement data.

## 2.9 Possible Risks And Risk Management

Our project is very passive in its effects on animal it is being placed on. While it will add some unwanted weight near a stitched area, it will not affect the animal in any other way. Some concerns we have is the potential increase in cost if our printed board doesn’t meet the requirements, our lack of knowledge when it comes to circuit board design, as well as our lack of past experience with data acquisition. We are taking early steps to avoid these issues in the future, however these issues can still arise.

## 2.10 Project Proposed Milestones and Evaluation Criteria

For the Spring semester a milestone that our team and the client agreed on was to have a working DAQ regardless of size that would be able to receive data from the sensor, filter it and display it. Another small goal is to begin developing an app that would add more functionality to our project. Within the semester some goals we have are to, understand the sensor, learn how to program the arduino, be able to collect data from the sensor using the arduino, filter the data, and to display the data. While these steps seem simple, it will take our team some time to get through each of these steps.

For the Fall semester our goal is to have our product on a board that we designed which will be lightweight and portable. We would also like to having a finished app which will somehow be able to connect to the DAQ. Assuming we have a working prototype going into the fall semester, some goals we have are to design a circuit board to our specifications, be able to transfer all our work onto this new board, run tests to make sure it meets all the requirements, finalize our app as well as its purpose for our project.

## 2.11 Project Tracking Procedures

We have created a basic timeline, posted in 3.1, that we will follow throughout the semester. We have also set-up weekly meetings as a group and bi-weekly meetings with our client to notify him of our progress. These measures will ensure that we stay on track or at least are aware of our progress of the overall project.

## 2.12 Expected Results and Validation

Our desired outcome is to have a DAQ built on our own printed circuit board that meets all the requirements provided by the client. We also want to have a working app that will be able to communicate with the DAQ.

To test that our product will work on a high level, we can simply use a machine provided by the client that can vary the resistance of the sensor based on user input.

## 2.13 Test Plan

Our goal is to develop a DAQ that will collect resistance data from a sensor provided by the client. Once we have a working model we can compare the results with the results from a multimeter. This will determine how accurate our measurements are as well as where the discrepancies are.

# 3 Project Timeline, Estimated Resources, and Challenges

## 3.1 Project Timeline

For now, the following timeline will show the following 8 weeks until end of this semester:

|  |  |
| --- | --- |
| Week 5 | * Design thinking |
| Week 6 | * First look how to use Ardunio * Run tests on sensor |
| Week 7 |  |
| Week 8 | * Find out how to store data on SD cards |
| Week 9 | * Try to put the individual parts of the project together |
| Week 10 | * Make necessary adjustments |
| Week 11 | * Make necessary adjustments |
| Week 12 | * Have a working prototype |
| Week 13 | * Plan out next semester |

Our project will be divided into major parts, in which parts 1, 2 and 3 should get completed by end of the first semester, while 4 and 5 by the end of the second semester of senior design:

1. Design thinking and brainstorming ideas
2. Obtain Basic understanding of the different parts of the project
3. Build a initial prototype
4. Reflect on the initial prototype and make improvements on the last model
5. Build a final product

## 3.2 Feasibility Assessment

We believe that this project is perfectly within reason for this time frame. Given that we have all the resources to test our project currently the success of this project relies on the amount of time spent on the project as well as learning the required material.

We already have an Arduino with built-in data storage, access to software to program the arduino as well as a sensor similar to the final product. We are beginning the testing phase of the arduino given to us to understand more about the hardware and software aspect of this project. With the reasonable timeline we have built, we believe this project can be completed.

## 3.3 Personnel Effort Requirements

Include a detailed estimate in the form of a table accompanied by a textual reference and explanation. This estimate shall be done on a task-by-task basis and should be based on the projected effort required to perform the task correctly and not just “X” hours per week for the number of weeks that the task is active

## 3.4 Other Resource Requirements

For the first prototype the group will use circuit boards and material that can be obtained from the electronic shop on Coover. However, for our final design we want to be able to print circuit board to solder the components of our DAQ. We will also need to add a data storage system onto our board so that the information can be stored and moved onto another platform.

## 3.5 Financial Requirements

For this project, financial requirements will be minimal, all of the hardware required are basic circuits board materials that are fairly inexpensive. The only part that would require some investment would be purchasing a microcontroller, which the group decided on buying an Arduino Board.

# 

# 4 Closure Materials

## 4.1 Conclusion

Our end goal for this project is to have developed a small and portable DAQ that will be able to filter and display data received from a biosensor placed on a dog. We must also develop an app with the goal of adding more functionality to our product. We must design a circuit board for our final product to add all the necessary components to make our project more personalized.

## 4.2 References

List all the sources you used in understanding your project statement, defining your goals and your system design. This report will help you collect all the useful sources together so you can go back and use them when you need them.

–  This component shall completely identify any material taken from other sources and used in the development of the project to date or are known that will be used during the remainder of the actual project

–  These references shall be complete so that any member of the plan’s audience could find them

- Have these on a separate page.

## 4.3 Appendices

If you have any large graphs, tables, or similar that does not directly pertain to the problem but helps support it, include that here. You may also include your Gantt chart over here.

–  Any additional information that would be helpful to the evaluation of the project plan or should be a part of the project record shall be included in the form of appendices

–  Examples of project documentation that might be included are property plat layouts or microprocessor specification sheets germane to the proposed project.