Team 8

Portable Healthcare Monitor

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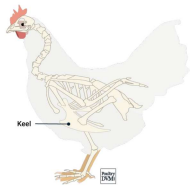
Sponsors: United States Department of Agriculture / National Institute of Food and Agriculture and Prof. Robert A Nawrocki

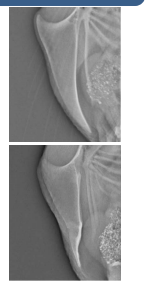
Customer Background

Commercial egg laying hens experience a high rate of Keel Bone Deformation (KBD). The cause of KBD is not fully understood, and the injury has both ethical and economic concerns.



Problem Statement

There is a high prevalence of fractured or deformed keel bones amongst chickens, sometimes as high as 80%, which can severely affect their egg laying ability.
The team has designed a module that will be used to test potential causes for keel-bone-deformation.

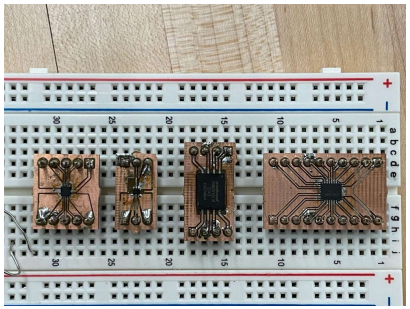


Requirements

This design needed to be capable of measuring data relating to a few possible causes for KBD, including impact forces, prolonged deformation, and the temperature of the subject. The client asked that the device have a minimum 24 hour battery and storage capacity.

Requirements	
Operating Time	24 Hours
	- Battery Life
	- Data Capacity
Data Collected	- Acceleration
	- Temperature
	- Force
	- Strain

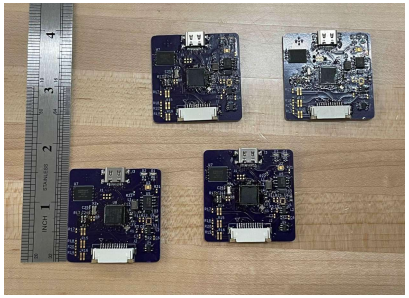
Experimentation and Concepts



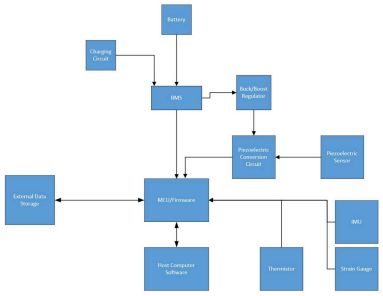
There are two main subsystems that required the use of different integrated circuits: power management and data management. The individual branches of the data and power management subsystems were individually built out in order to ensure functionality of the system, as well as to meet the design requirements.

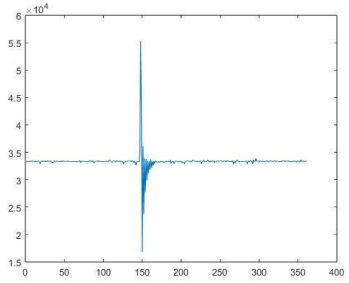
Circuit Subsystems	
Power Management	- Battery
	- Charging Circuit
	- Charging Port
Data Collection	- Microcontroller
	- Data Port
	- IMU
	- Thermistor
	- Force Sensor
	- Strain Gauge

Final Design

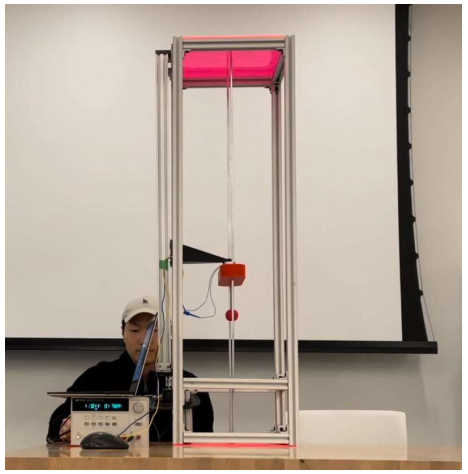


The final design consists of a small PCB designed with the suite of instrumentation and data collection circuitry that was breadboarded during experimentation and concept development. Pictured are four assembled units sans Battery and external sensors, and a recorded impact on a piezoelectric sensor.

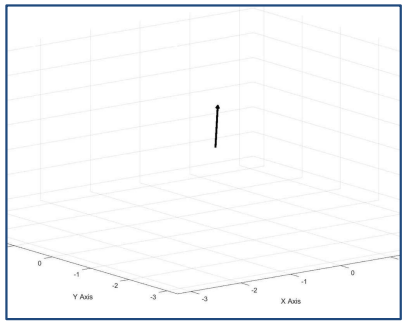




Testing



A test station has been developed to assess the accuracy of the piezoelectric and strain gauge sensors. The sensors are tested by a ball connected to a slider, which strikes the sensor from varying heights. The height is adjusted by a servo motor to ensure consistent testing conditions and stability. This setup allows for precise evaluation of the sensor's performance under controlled conditions



The accelerometer integrated into the IMU provides acceleration and gyroscope data for the X, Y, and Z axes. The gyroscope data indicates the direction of movement, allowing us to analyze the chicken's movement and its trajectory.

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