Ford Otosan

Design of a Calibration Test Setup for a 3-Axes Accelerometer

Sabancı Üniversitesi — FACULTY OF ENGINEERING AND NATURAL SCIENCES

Student(s)

Onur Ozan Canatan
Mert Karabağlı
Hakkı Görkem Gürüz

Faculty Member(s)

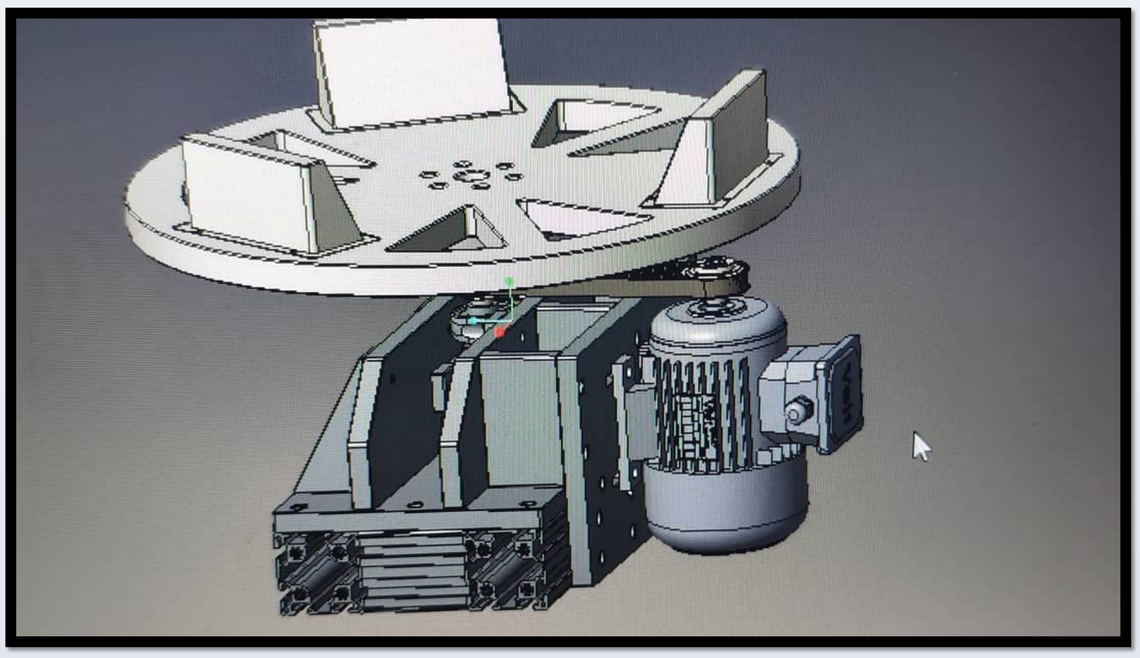
Bekir Bediz

Company Advisor(s)

Fırat Yıldız

ABSTRACT

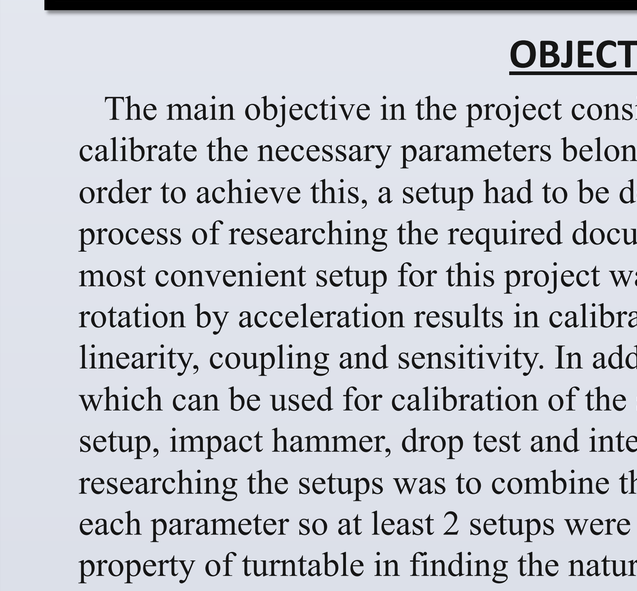
The calibration of a 3-axes Accelerometer is concerned in this project. Accelerometers are used to measure acceleration (change in velocity of the considered object) and vibrations. The importance of the accelerometer relies on the fact that they are used in daily life and have a wide range of functionalities like dynamic use to determine the moving of objects, their gravitational pull measurement or digital use in computer's hardware. Calibration of the multiple axis accelerometers have a significant role in industry in order to observe their range, natural frequency, linearity and sensitivity. In the project named "Design of a Calibration Test Setup for a 3-axis Accelerometer", the calibration of the parameters in the preceding statement have to be done and the objective is to prepare a setup which will assist to calibrate the accelerometer.

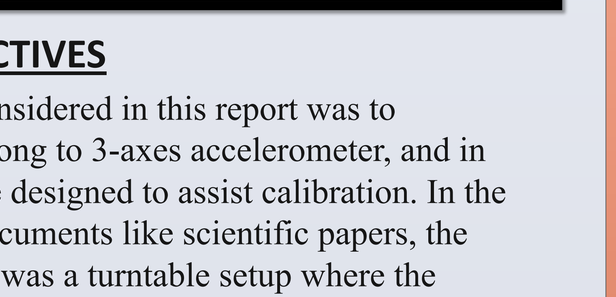


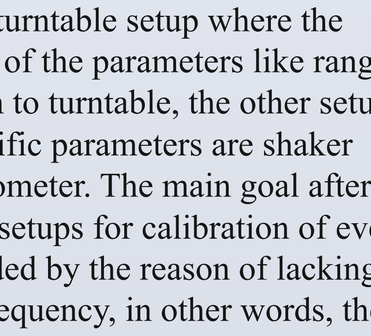
OBJECTIVES

The main objective in the project considered in this report was to calibrate the necessary parameters belong to 3-axes accelerometer, and in order to achieve this, a setup had to be designed to assist calibration. In the process of researching the required documents like scientific papers, the most convenient setup for this project was a turntable setup where the rotation by acceleration results in calibration of the parameters like range, linearity, coupling and sensitivity. In addition to turntable, the other setups which can be used for calibration of the specific parameters are shaker setup, impact hammer, drop test and interferometer. The main goal after researching the setups was to combine these setups for calibration of every each parameter so at least 2 setups were needed by the reason of lacking property of turntable in finding the natural frequency, in other words, the turntable setup is not enough by itself to calibrate all of the properties needed.

PROJECT DETAILS



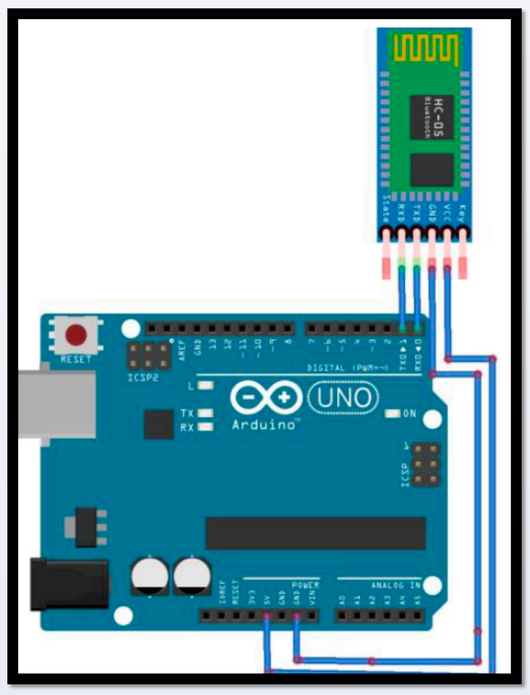


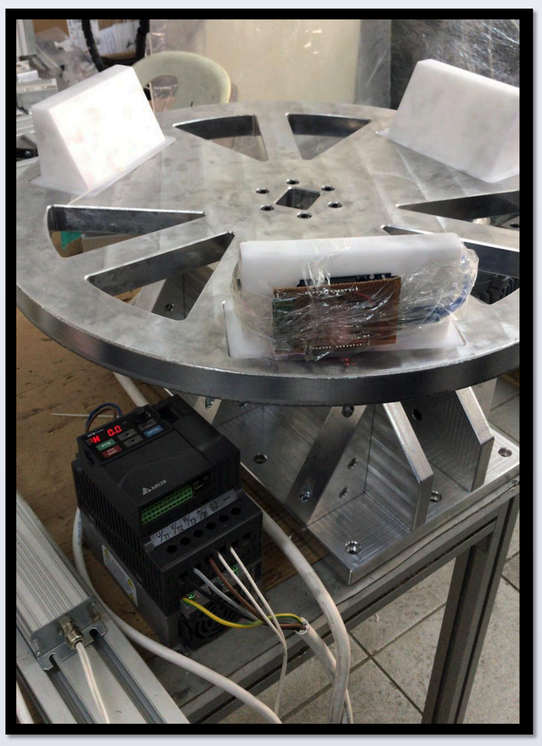


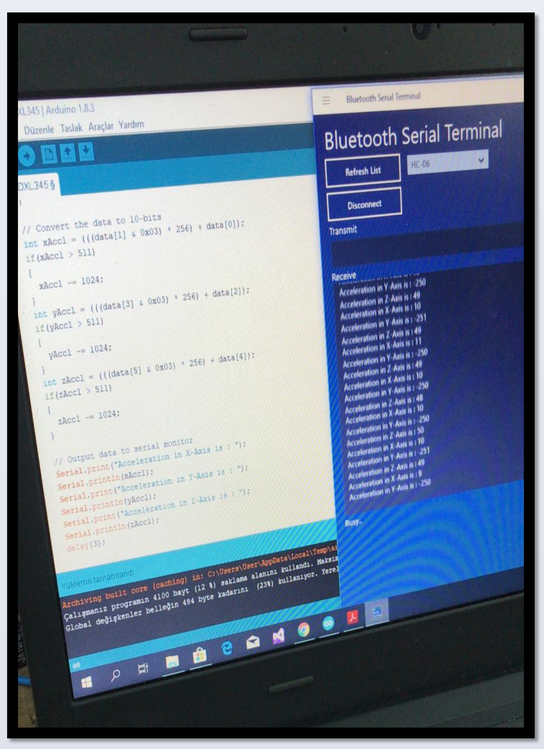
A rate table is used to generate the acceleration, but in this situation, the input acceleration needs to be analyzed to three components 1, 2, and 3. Therefore, in order to test the three axes of the sensor at once, the orientation of the sensor has to be changed so that the acceleration generated by the rate table and the gravity acceleration are distributed equally on the three axes.

IMPLEMENTATION & TESTING

The accelerometer considered in this project has three axes and the one must gather the data from every each axes. The Kistler model accelerometer gives an analog output instead of digital and its output is connected by a connector with 3 pins. These pins are connected to the analog input pins of Arduino. The analog output signals can be modeled by a sinusodial, thus the calibration system must sample as many data as it can in the considered frequency levels. The operating frequency level of HC-06, the prescale factor of Arduino(Analog-to-Digital Converter) shall be considered to measure the data rate while getting the data from the accelerometer.

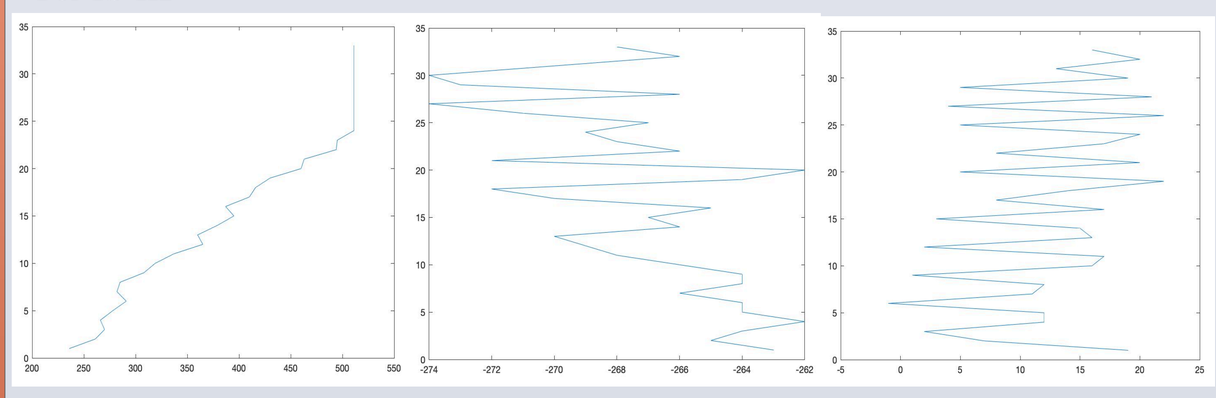




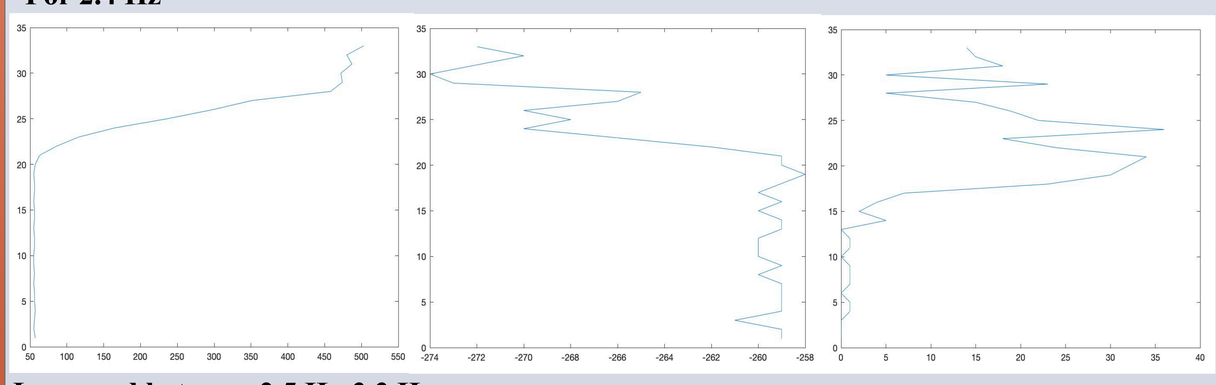


CONCLUSIONS

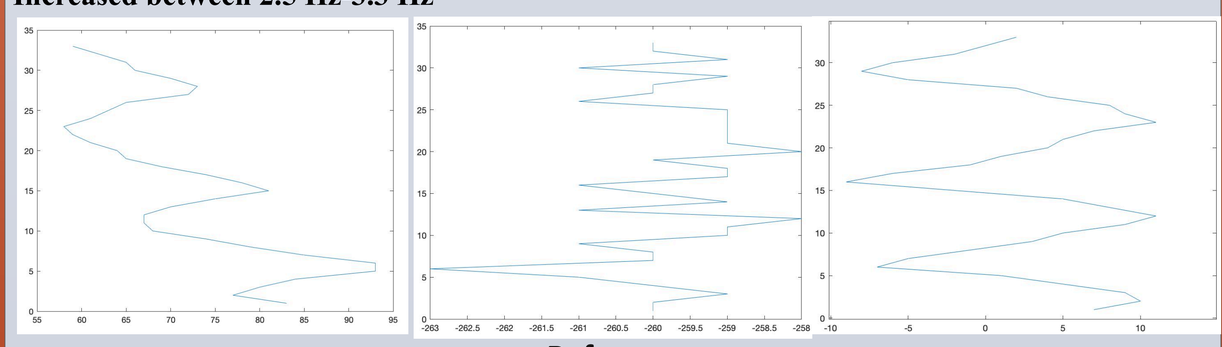
For 1.9 Hz



For 2.4 Hz



Increased between 2.5 Hz-3.3 Hz



References

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