HACETTEPE UNIVERSITY DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING ELE 401-402 GRADUATION PROJECT

Diagnosis of Sleep Apnea Using Non-Contact Breath Temperature Measurement

Supervisor

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1. Introduction

- Sleep apnea is sleep disorder which breathing stops at least 10 seconds and frequently during sleeping. The patient often wakes up during night, often feels tired in day and inefficient during the day as short time effects. Sleep apnea is a disease that can be seen in both sexes and all ages. Although it is a disease that can be ignored by patients because it is not directly fatal, it has effects such as cardiovascular diseases, heart disease, metabolic disorders, depression, many traffic accidents and accidents with heavy machinery in the long term.

2. Work Flow

- A suitable sensor is selected to obtain the temperature gradient
- sensors receive data as an array for increase accuracy.
- The microcontroller sets up the I2C connection to communicate with the sensors, and the UART connection to communicate with the computer.
- The microcontroller transmits the data it receives from the sensors as an array to the computer.
- The computer categorize the data and processes it by multithreading.
- The data are visualized and graphed so that the user can notice more easily.
- If the user wishes, they can also call MATLAB graphics from the same interface or enlarge them by clicking on the graphics in the interface.
- Algorithm follow the head moves of the patient and at the end of the procedure, sleep apnea is found by algorithm after that 10-second breaks in breath.

3. Test and Results

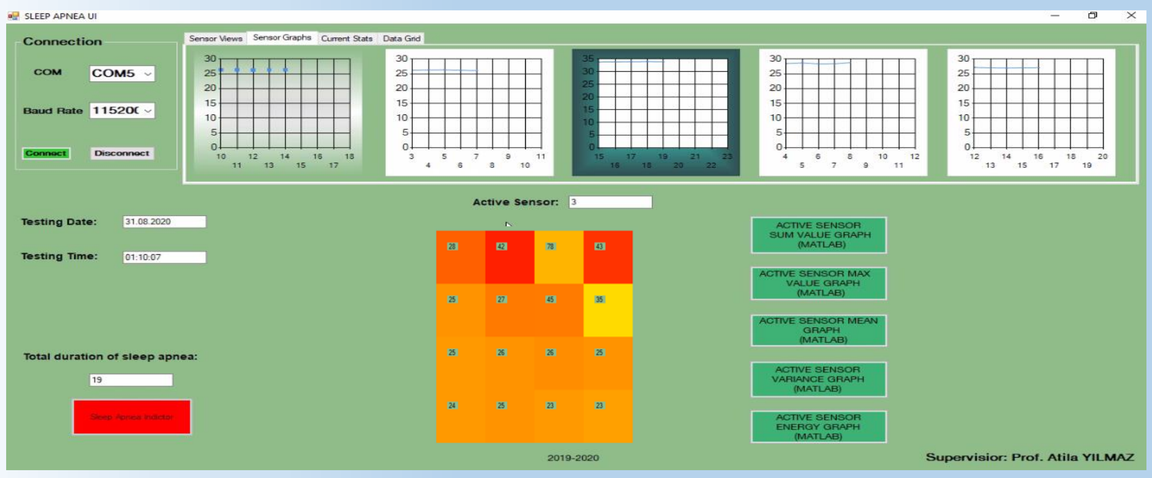

Figure 1: Graphical User Interface (GUI)

Figure 2: Circular Sensor Base

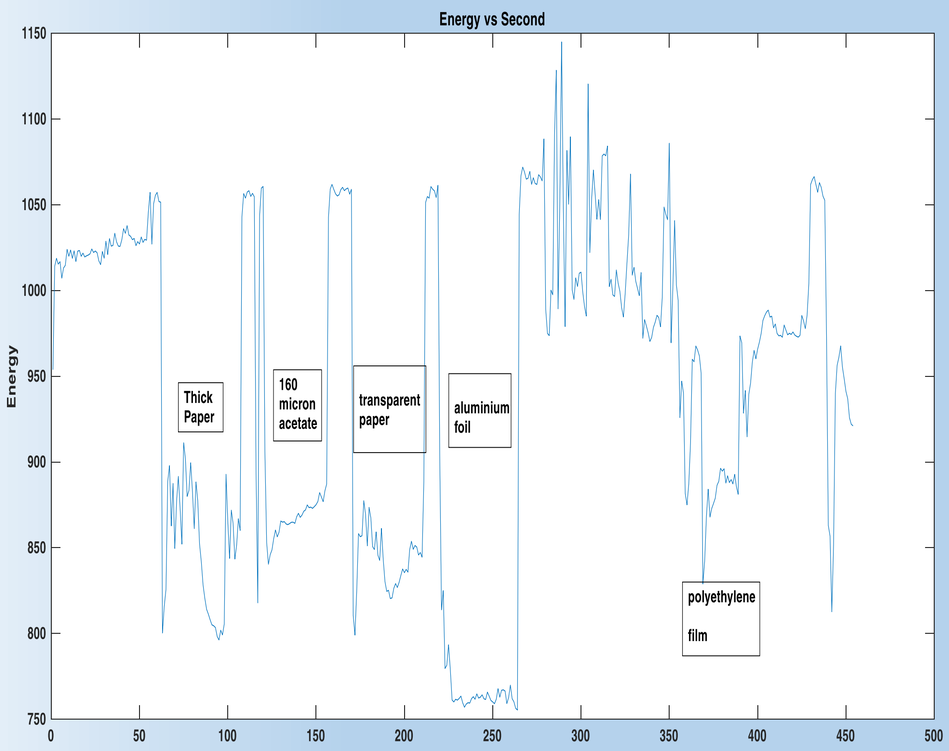

Figure 3: Energy/Second Plot for Different Materials

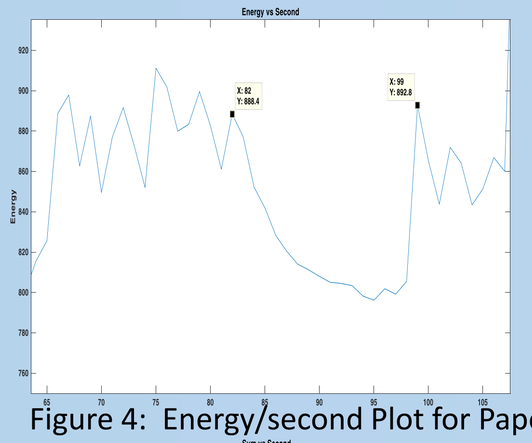

Figure 4: Energy/second Plot for Paper

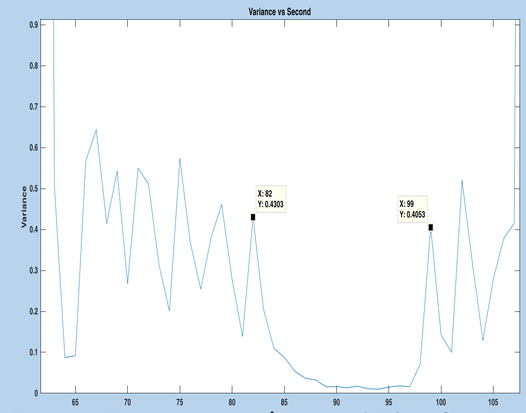

Figure 5: Variance/second Plot for Paper

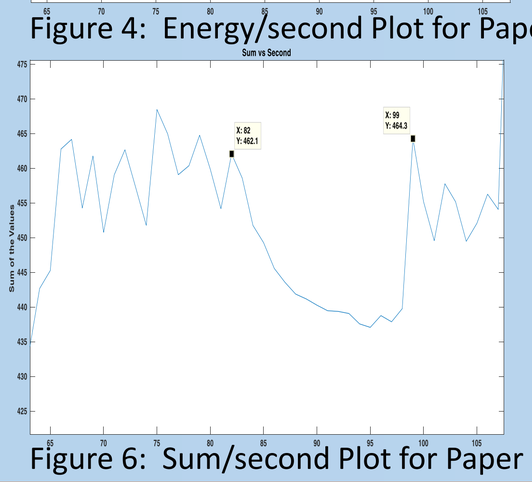

Figure 6: Sum/second Plot for Paper

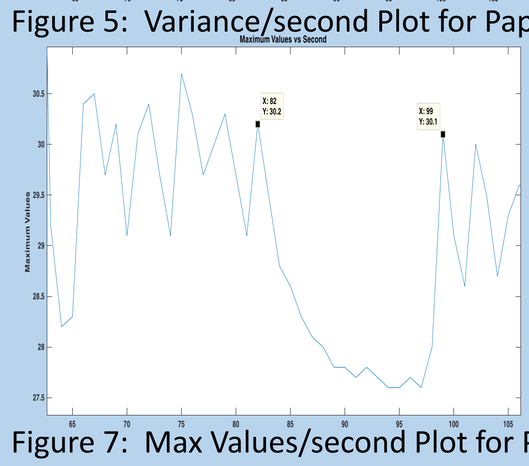

Figure 7: Max Values/second Plot for Paper

Results and Discussion

- In this project, sensors were placed on a framed base to detect sleep apnea without contacting the patient. In this way, the collected data is processed with the multithreading method and displayed to the user over the GUI. This method allows the patient to be diagnosed without reducing the sleep quality. The algorithm has successfully achieved the time and duration of sleep apnea even if the patient holds his head in different positions.

References

[1] "American Academy of Sleep Medicine - Sleep Education," [Online]. Available: http://sleepeducation.org/essentials-in-sleep/sleep-apnea/overview-facts. [Accessed 6 April 2020].

[2] "American Sleep Apnea Association," [Online]. Available: https://www.sleepapnea.org/learn/sleep-apnea/. [Accessed 8 April 2020].