Distant Temperature Measurement for Detecting Sleep Apnea Episodes

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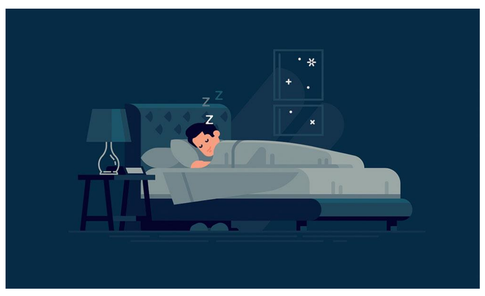
Introduction

- Sleep apnea is common respiratory disease caused by obstruction of the airways, especially during a deep sleep. Short periods of inability to breathe (at least 10 seconds) or prolonged breathing difficulties during sleep are the most common symptoms. Sleep apnea can occur due to obesity, stenosis in the human throat, large tonsils and incorrect sleep positions.
- Infrared temperature sensors are used to detect sleep apnea episodes. These sensors measure temperature data from a distance. In order to get data from a IR temperature sensor ,a microcontroller is used.

Application Areas

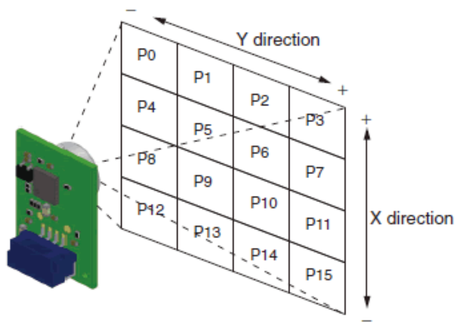


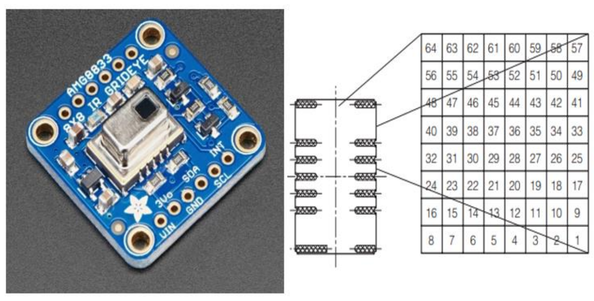
HOME

HOSPITAL

Specifications and Design Requirements

- Omron D6T-44L and AMG8833 infrared temperature sensors are used to detect temperature variation of a patient's respiratory. Sensors have different field of view.





64	63	62	61	60	59	58	57
56	55	54	53	52	51	50	49
48	47	46	45	44	43	42	41
40	39	38	37	36	35	34	33
32	31	30	29	28	27	26	25
24	23	22	21	20	19	18	17
16	15	14	13	12	11	10	9
8	7	6	5	4	3	2	1

Solution Methodology

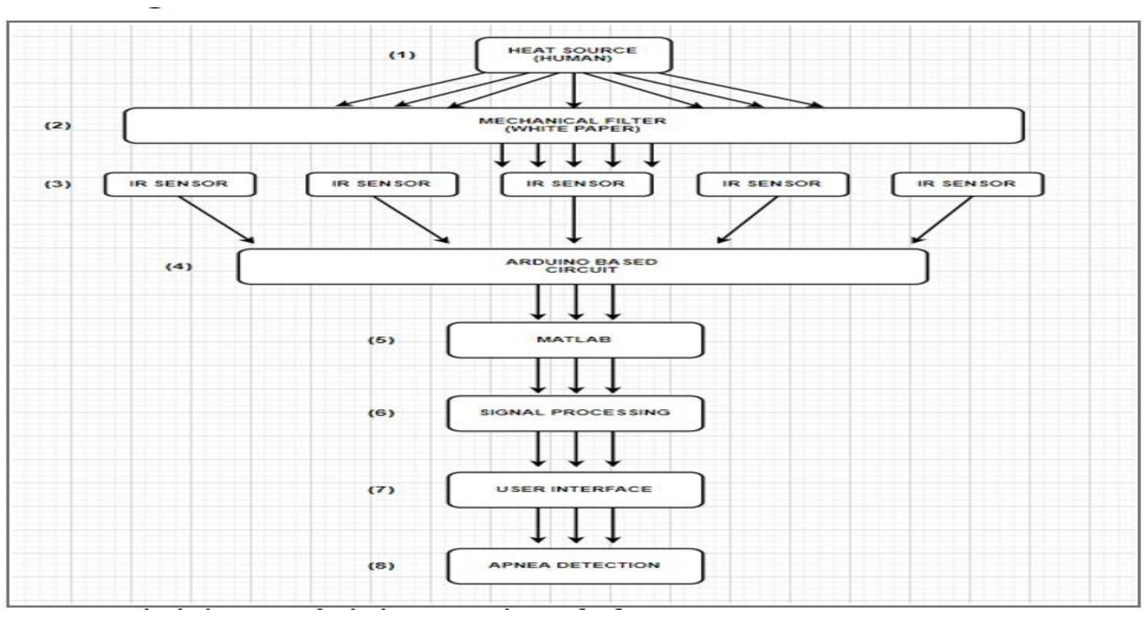


Figure: An overall software design of the project.

- The temperature change in the mouth area during the patient's breathing is detected by the sensors after the filtration. The purpose of the filter is to observe the temperature changes in the mouth area more easily and clearly. The instantaneous temperature values are transferred to the Arduino UNO by the sensors. The temperature data is printed on the serial port screen. Then data is transferred to MATLAB via serial port communication. Signal processing techniques are applied to the temperature data in MATLAB.

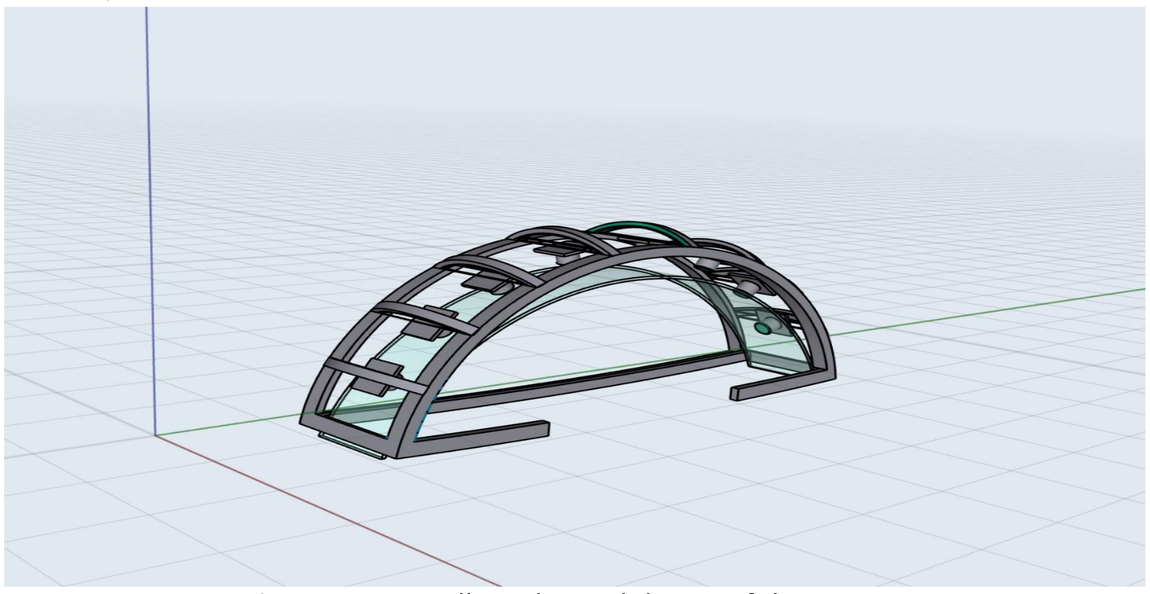


Figure: An overall mechanical design of the project.

Results and Discussion

- In this project, two different types of sensors were used to detect sleep apnea. Since these sensors measure without contact, patient comfort has been increased. With the designed interface, the breathing temperature of the patient was observed. During the patient's sleep period, the number of apnea episodes which are detected by the algorithm was displayed on the screen synchronously.

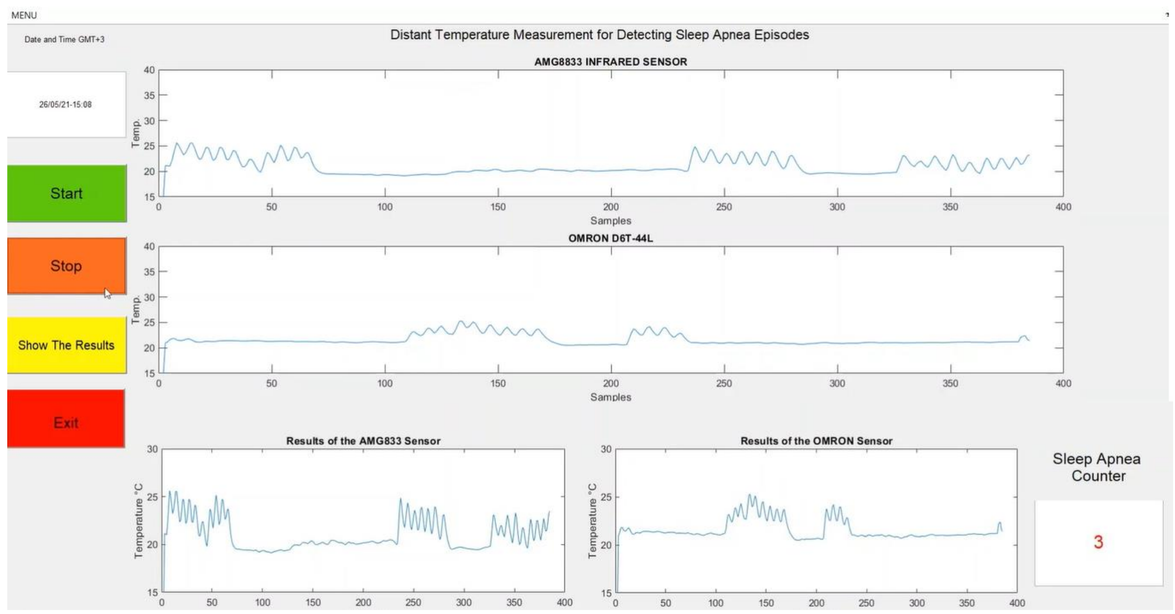


Figure: Graphical User Interface

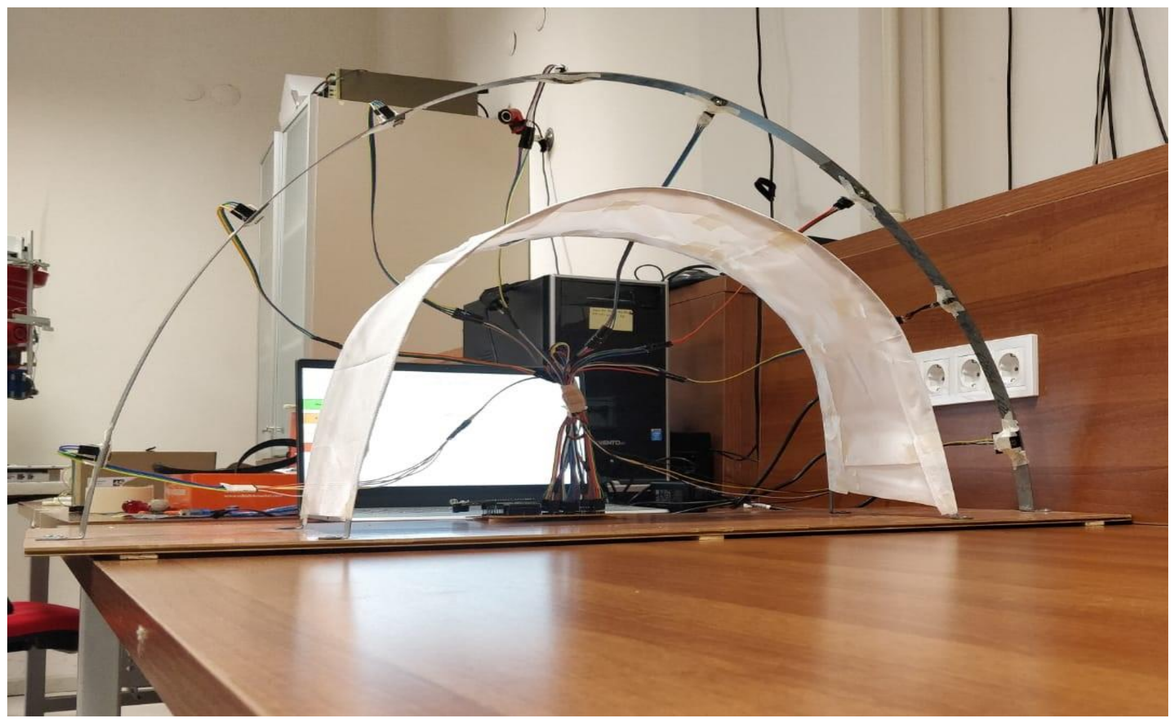


Figure: Final Design of the Project

References

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[2] Fei J., Pavlidis I., Murthy J. (2009) Thermal Vision for Sleep Apnea Monitoring. In: Yang GZ., Hawkes D., Rueckert D., Noble A., Taylor C. (eds) Medical Image Computing and Computer-Assisted Intervention – MICCAI 2009. MICCAI 2009