



# Portable Respiratory Sound Recorder

Ahmet Tuğra İŞLEYEN

Supervisor

Prof. Dr. Uğur Baysal

Electrical and Electronics Engineering, Hacettepe University



## Introduction

- The aim of this project is to record and digitalize lung sounds after that transferring with digital platforms.
- Another goal of the project is to track lung sounds without bringing together the patients and doctors.
- Digitization and monitoring of lung sounds has been set as the goal.

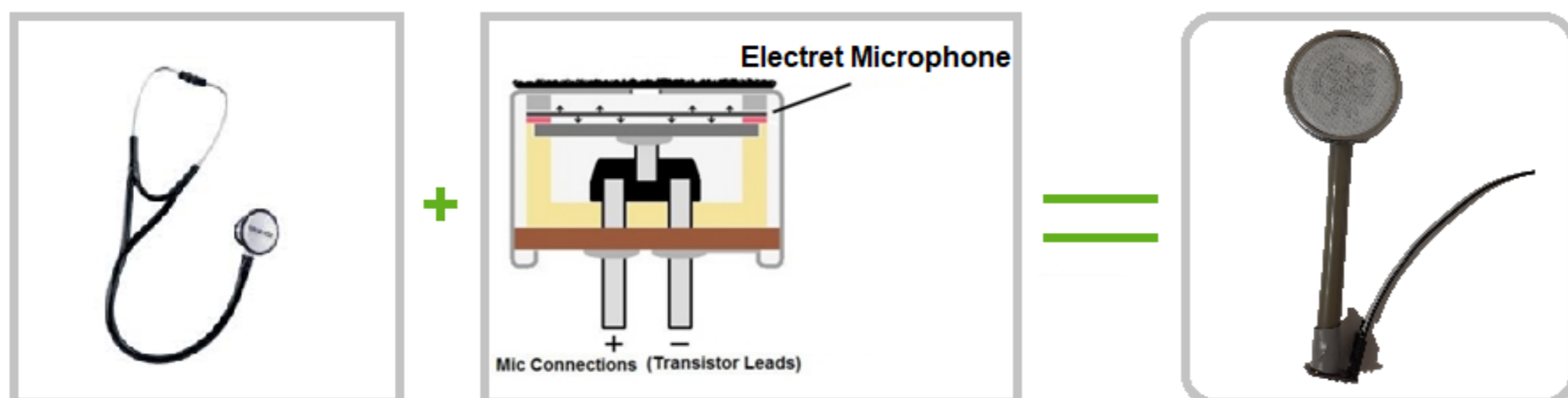
## Specifications and Design Requirements

- It can digitize lung sounds by measuring analog signals at a frequency that can distinguish lung sounds.
- The data obtained can be stored in the storage unit.
- Lung sounds data can be transferred to computer environment.
- The data can be converted into audio files and, if necessary, graphed and analyzed.
- It can get a much cleaner sound by filtering the sounds far above the lung sounds.
- It is easy to use, portable and small.

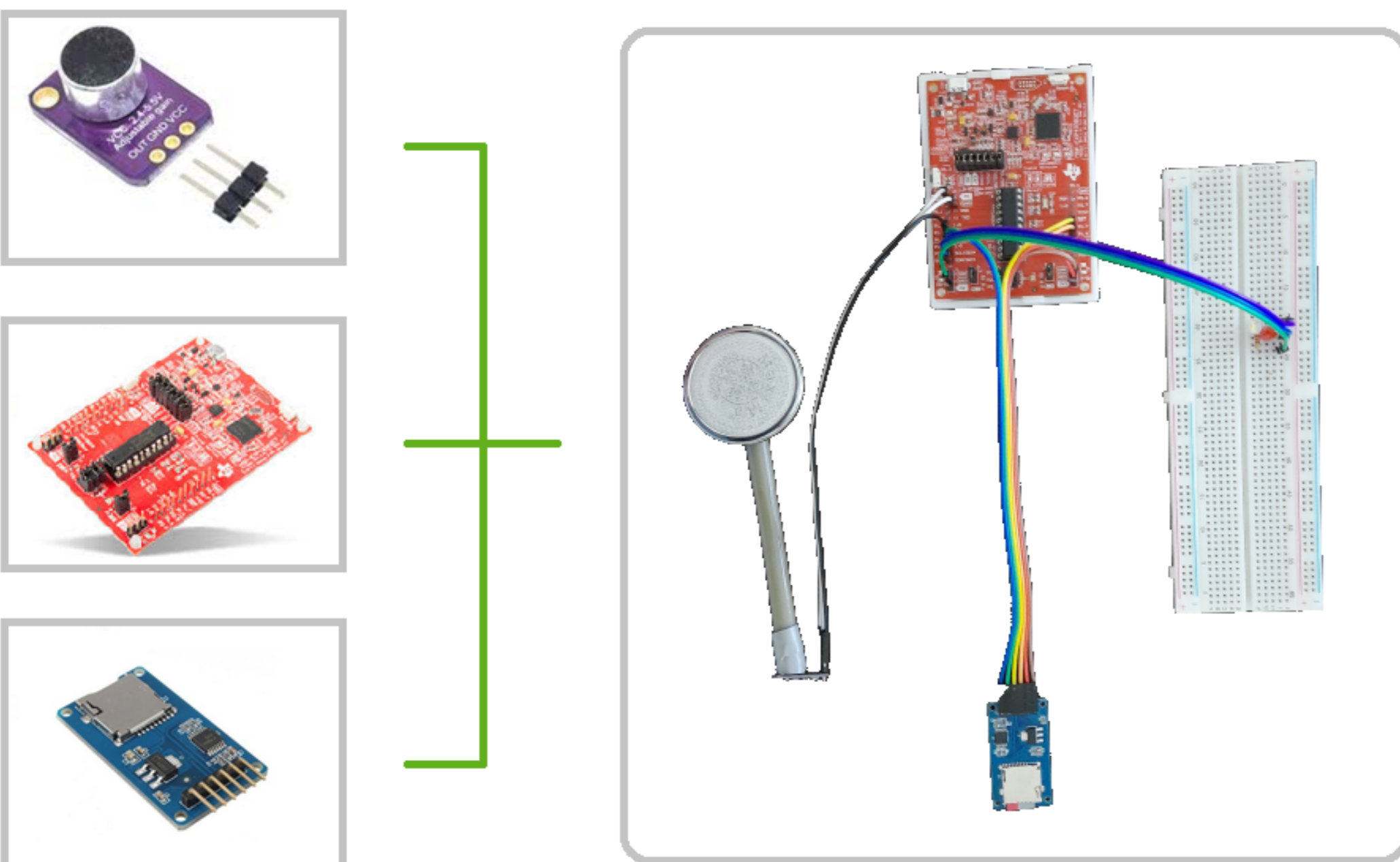
## Solution Methodology

- ✓ The main feature of the system is that it concentrates on lung sounds. Lung sounds contain very low frequency sound waves and not every microphone can detect these sounds. Electret microphones are microphones capable of detecting these sounds.

### MICROPHONE STRUCTURE



### BASIC COMPONENTS AND SYSTEM



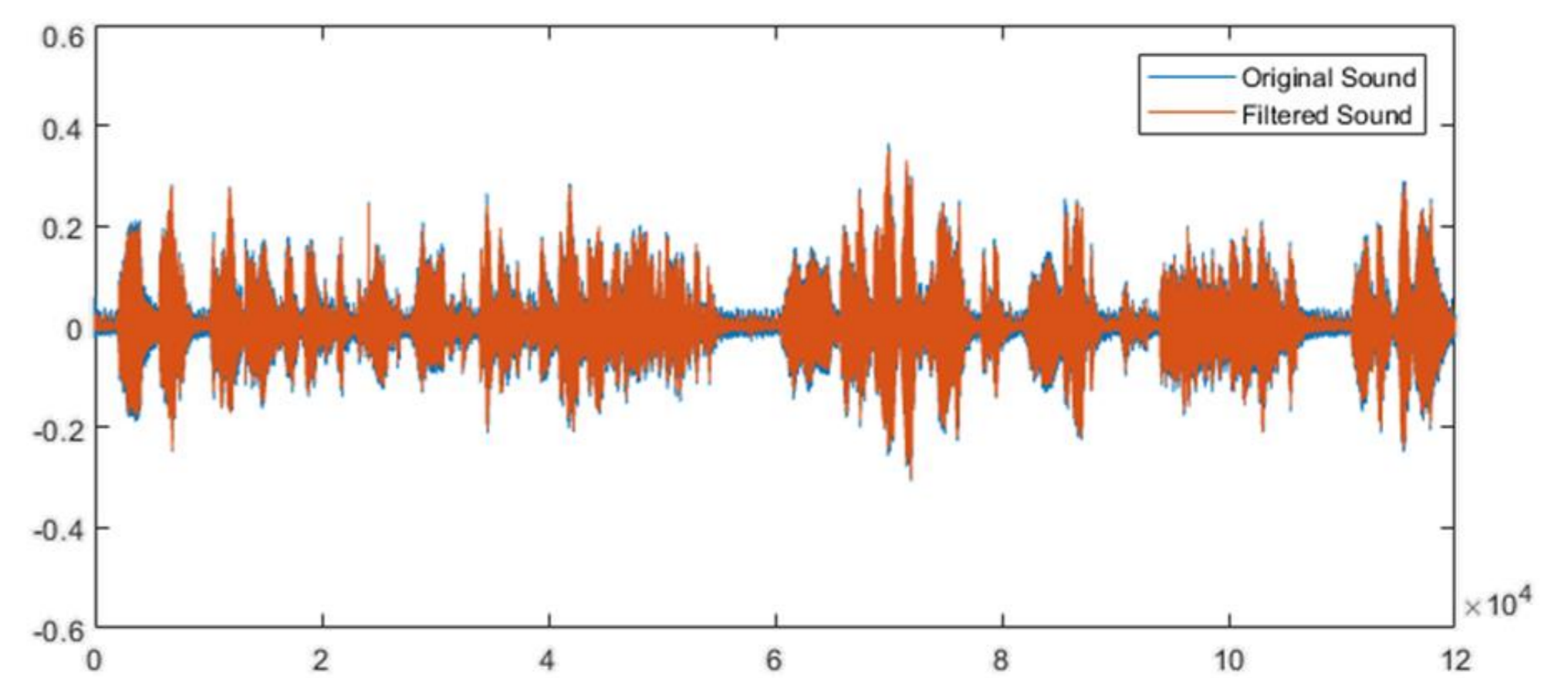
- ✓ In the project realized by using MSP430G2553, electret microphone and SD card reader, first analog audio data from the microphone was converted to digital data at 10-bit resolution. This audio data was then recorded on the SD card using the "USCI SPI" mode.
- ✓ This data recorded on the SD card was transferred to Matlab after the necessary preliminary processes and converted into audio data and graphics through Matlab. At the same time, analyzes were carried out on the data converted into graphics and the sound perception capacity of the microphone was evaluated.

## Application Areas

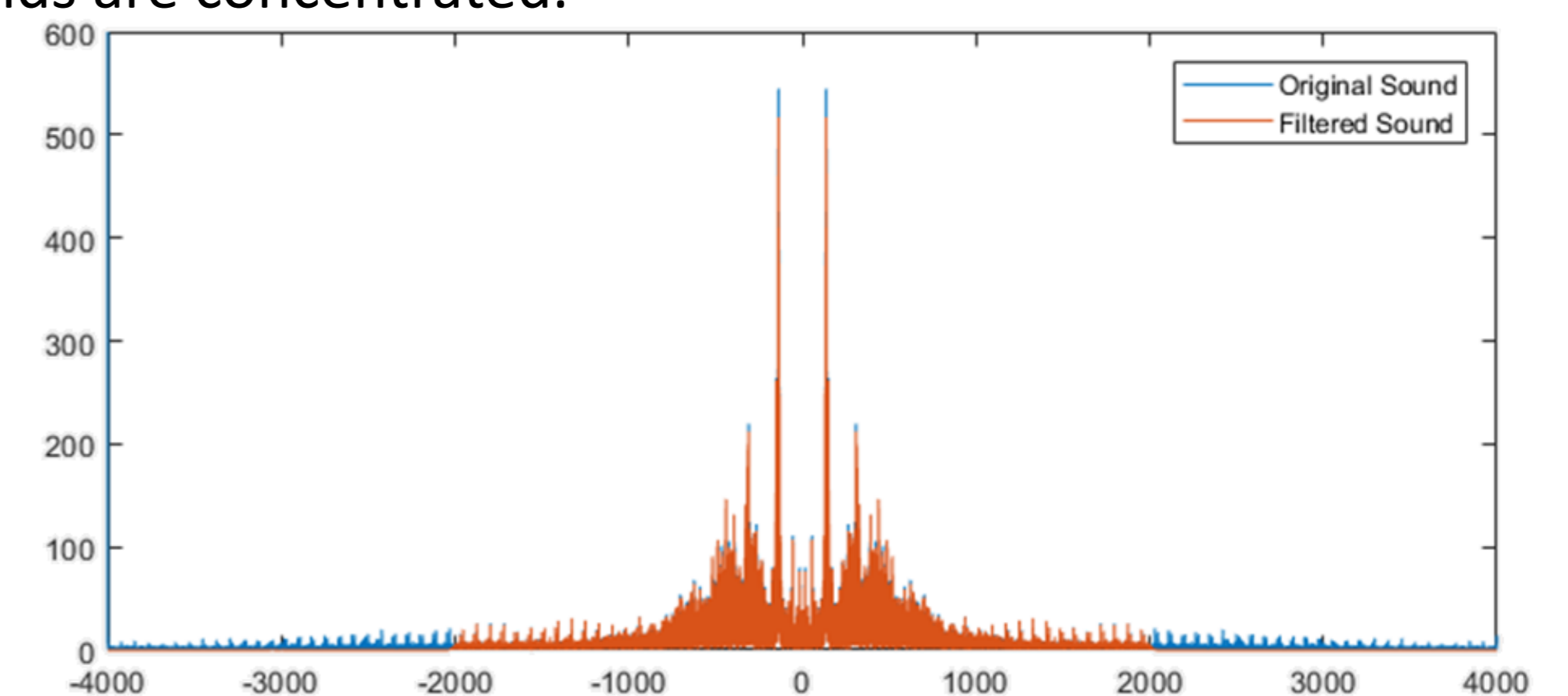
- It can be used for the patients with chronic respiratory problems and who need regular monitoring.
- This device can be preferred to store data for research and development projects about lungs sounds.
- It can be used for monitoring and understanding the progress of diseases.
- In order to reduce crowd in hospitals, patients who go to the hospital regularly may be preferred.

## Results and Discussion

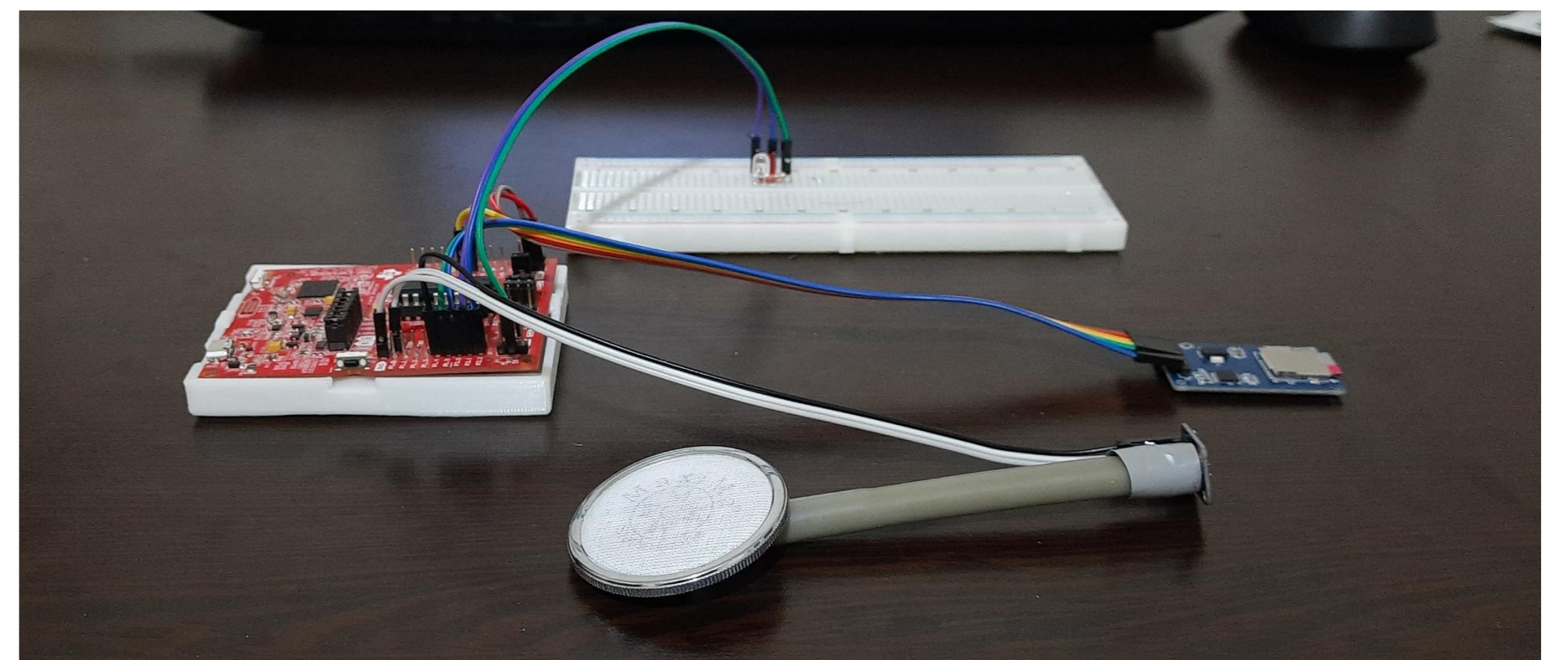
- ❖ Data are transferred to the computer via an SD card reader. The transferred data becomes readable and processed by Matlab after going through some processes.



- ✓ The values obtained were examined in time and frequency graphs. As a result of this process, we can see at which frequencies the sounds are concentrated.



- ✓ Sounds of 2KHz and above were not defined as lung sounds and a cleaner sound was obtained by filtering. We can see the filtered and unfiltered version of the sound obtained in the graphics together. Filtered sound is clearer and more understandable. The sound data obtained was then converted into ".wav" format and made suitable for its purpose.



## Acknowledgements

- ❖ This project was completed within the context of ELE401-402 Graduation Project courses in Hacettepe University, Faculty of Engineering, Department of Electrical and Electronics Engineering.
- ❖ We thank Prof. Dr. Uğur Baysal for his invaluable contributions to our project.