Cost-Efficient and Precise Manometer for Thoracentesis

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Thoracentesis is a surgical procedure where a needle is inserted into the pleural cavity around the lungs to extract pleural fluid. Measuring the pleural pressure during thoracentesis is a good way to optimize the amount of fluid withdrawn and to avoid complications that may occur. However, the only commercial digital manometer is approximately $110. It is a disposable, single-use device not specifically designed for thoracentesis which causes inaccuracies due to its large measurement range. My project is to create a precise, low cost, and reusable pleural pressure reader that can be used during thoracentesis. This device contains many components such as a microcontroller, sensor, and screen. A circuit board was designed and manufactured to incorporate these components while a fully enclosed wireless charging case allows the device to be sterilized and therefore reusable. Since pressure sensors generally measure gasses, a disposable chamber containing a membrane and a Luer lock system was incorporated into the outside of the device to allow pleural fluid pressure to be measured. Using an existing model of membrane deformations, the area, width, and material of the membrane were optimized while also optimizing the measurement range of the sensor. This device incorporates a reusable and sterilizable apparatus, a disposable membrane component, and a Luer lock system to minimize costs while also achieving a higher level of precision that allows doctors to make the most informed decisions to benefit their patients.

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