CSE-316
[Microprocessors, Microcontrollers and Embedded Systems Sessional]

Term Project:

NON-INVASIVE MECHANICAL VENTILATOR

Submitted by:

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02.09.2022

1. Circuit Diagram:

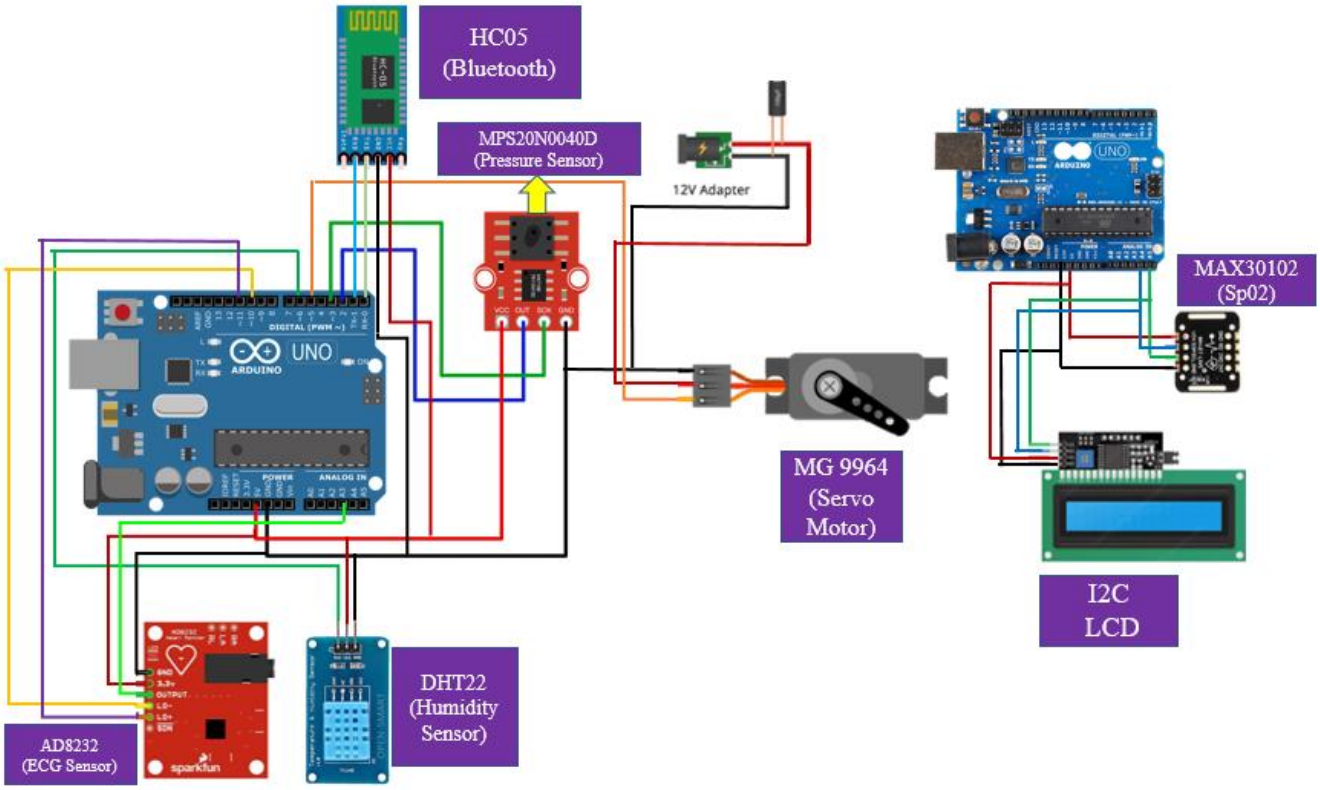
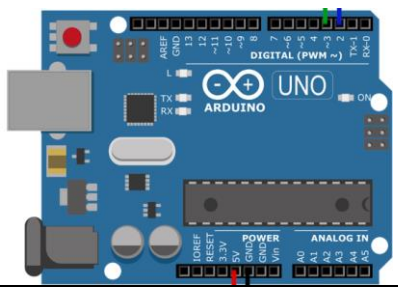
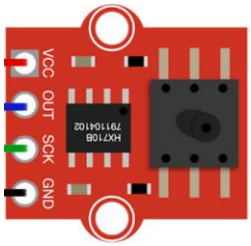
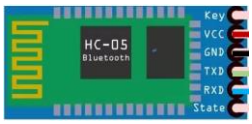
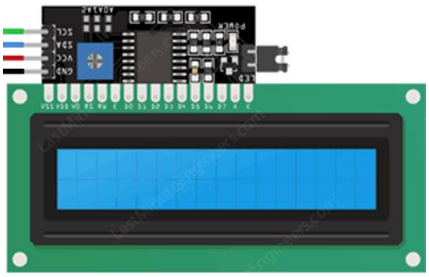
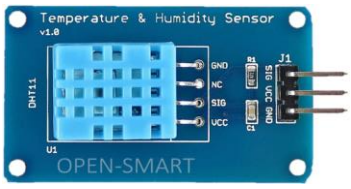
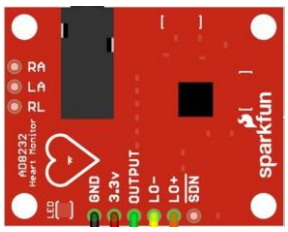


Figure 1: Circuit Diagram

2. Instruments:

2.1 Electrical and Electronic:

Sl. No.	Component Name And Description	Image	Quantity
1.	**Arduino Nano (*Micro-Controller*)** **[**The main microcontroller for this project]		2

2.	**MPS20N0040D (*Pressure Sensor*)** [For detecting the breathing cycle of the user]		1
3.	**HC05 (Bluetooth Module)** [For transferring data to and from the Mobile App]		1
4.	**MAX30102 (Sp02 Sensor)** **[** Measuring the Oxygen Saturation of the User **]**		1
5.	**I2C LCD** **[**For displaying real-time SPO2 readings**]**		1
6.	**DHT22 (Humidity Sensor)** [For measuring the temperature and humidity of supplied air]		1
7.	**AD8232 (ECG Sensor)** **[**Sampling Data for ECG graph on app**]**		1

8.	**MG 996R (Servo Motor)** **[**For driving the pumping mechanism**]**		1

2.2 Mechanical:

1. **Ambu-Bag**
   [A medical device that requires manual pumping for artificial ventilation]

2. **Shaft, pivot and force-applier**
   [This part is up to the design implementer. We made a simple, type-2 Lever]

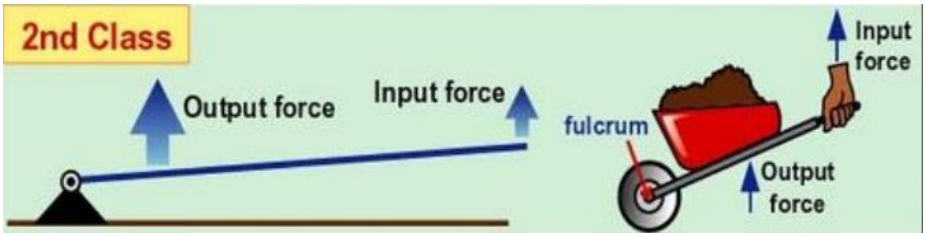


Figure 2: Class- 2 Lever

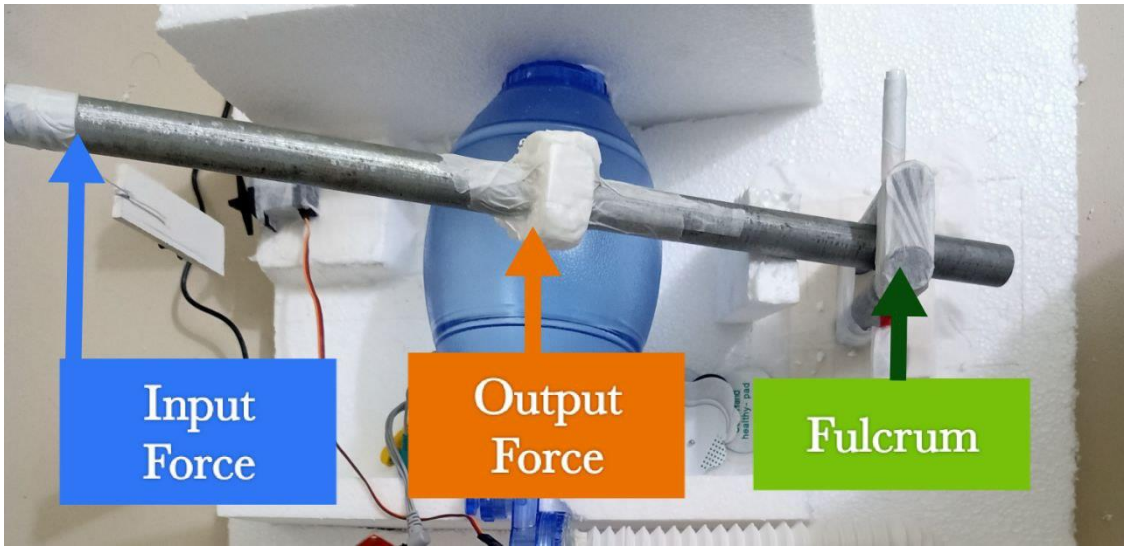


Figure 3: Our used Class-2 Lever

3. ISSUES AND SOLUTIONS:

3.1 Issues with Stepper Motor:

We planned to use a Nema 17 stepper motor for our project as we needed relatively higher torque to compress the Ambu-bag. However, while using the motor with the motor driver, the rotation precision was very inaccurate. Controlling stepper motors with precision requires a proper current limit into the motor driver. However, due to an issue with the potentiometer of the motor driver of the unit we used, the stepper motor did not provide the rotation we expected.

Solution:

To resolve the issue, we moved to Servo motors (better precision). We used an MG996R servo motor which has a better torque output (around 15 N/cm) than widely available servo motors (SG90s).

3.2 Issues with power management:

The overall circuit sensors use 5V supply to operate. However, the servo motor required around 7V to operate, along with a heavy current requirement (around 500-900 mA @6V).

Solution:

So we use a separate power module for this purpose. The power flow for the servo motor follows this sequence:

*220V Ac supply → **12V Adapter** → 12 V Dc output → **Bulk Module** → 7V Dc Output*

The ground ports of all the devices, including the bulk module are shorted to ensure a common ground to the whole circuit.

3.3 Issues data transmission with developed app:

- Our App (developed using MIT App Inventor) would call a function to detect new inputs through the Bluetooth module. Initially his function call rate was lower than the data transmission rate. As such, the app would miss some transmitted data.

- Besides, the app had a preset “Delimiter” character (ASCII 32, ‘ ’) that would signal the end of transmitted data. Initially our Bluetooth module delimiter (‘\n’) was different from the preset one. This would cause the app to keep on reading data (and consequently fail)

Solution:

- We re-set the function call rate to sync up with the data transmission rate, through the app inventor.
- We changed the app delimiter to ‘\n’, through the app inventor

4. APPENDIX:

- Github Link to all our codes: https://github.com/TokiTahmid64/NON-INVASIVE-MECHANICAL-VENTILATOR
- Full Image of our Project:

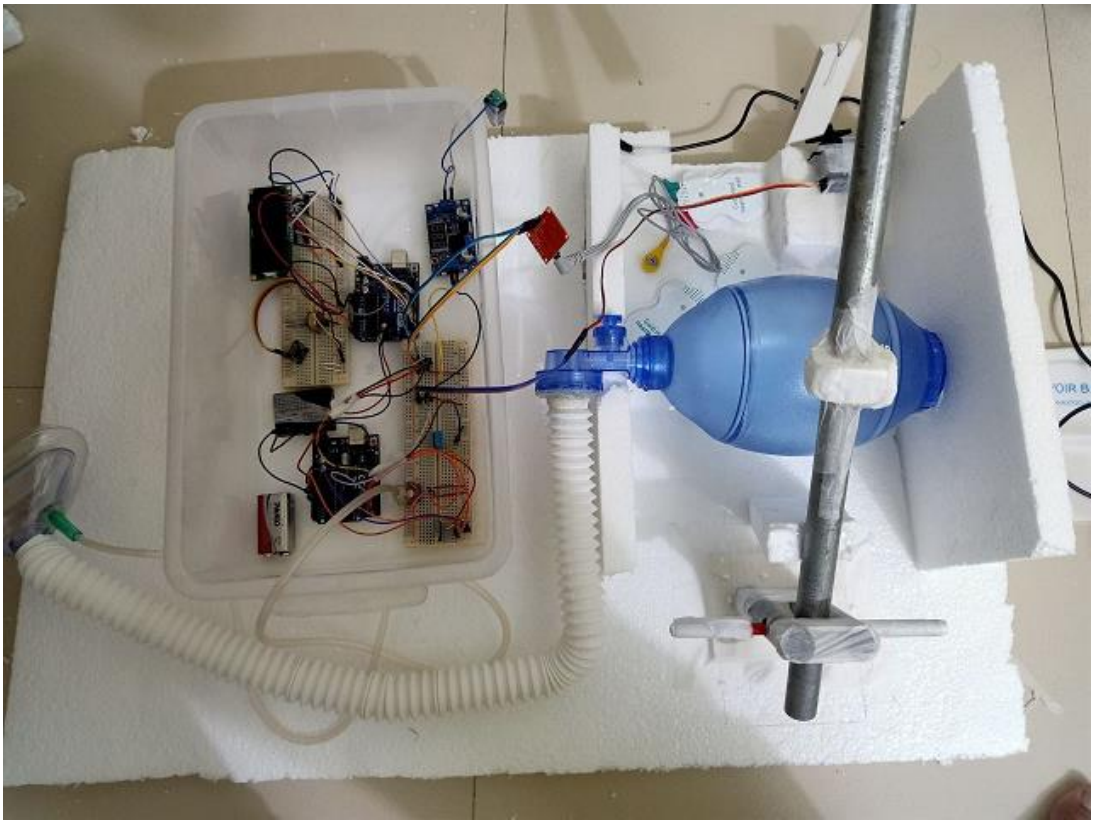


Figure 4 The Full Picture

5. ACKNOWLEDGEMENTS:

MIT App Inventor: https://appinventor.mit.edu/