CoVen19 v1.0

We are looking for following code functionality to CoVen19 v1.0 based of Arduino UNO board.

Functional Steps:

1. Power on
2. Boot up
3. Check status to Air Volume potentiometer(A)
4. Set variable speed as per potentiometer input
5. Check status of breath cycle potentiometer(B)
6. Set variable speed of breath cycle as per potentiometer input (see explanation below)
7. Display status to OLED (e.g. Air Volume potentiometer step, number of breath cycle etc.)
8. Display hardware of critical function errors to OLED
9. Activate buzzer in case of hardware failure etc.
10. Start NEMA 17 motor according to set combination of Potentiometer(A) and Potentiometer(B)
11. Loop full cycle until mains power off

Air Volume Potentiometer (A)

For Air Volume control break potentiometer(A) rotation virtually in to 5 steps as shown in below **Table 1**, meaning each part of degrees rotation, there should be approx. 20mm actuator displacement towards Ambu bag.

Example: If we assume potentiometer is having 360 full rotation; then 1st step will be about 0-72 degree. Arduino should read 1 step up to 72 degree, then Arduino should read step 2 upon rotation of 72-144 degree. Similarly, upon full rotation of 360-degree, Arduino should read 5th step; so, Actuator will be at fully expanded position. Similarly, decrement of degree should reverse the decrease step numbers. (This will help to use various BVM Ambu Bags and delivers right amount of air to lungs)

Table 1: Functionality of Air Volume Potentiometer(A)

Air Volume potentiometer(A) Functionality * Assuming potentiometer has 360-degree rotation and virtually break down to 5 steps					
Degree of rotation	0 - 72	73 - 144	145 - 216	217 - 288	289 - 360
Virtual Step	1st	2nd	3rd	4th	5th
Actuator displacement	Position From 0mm to 20mm	Position From 20mm to 40mm	Position From 40mm to 60mm	Position From 60mm to 80mm	Position From 80mm to 100mm

Breath Cycle Control Potentiometer (B)

For Breath cycle control potentiometer(B) rotation of full 360 degree, virtually break it into 9 steps as shown in below **Table 2.** Now, at first position of rotation between 0-40 degree, Arduino should read 12 breath cycles per minute; which mean a single breath cycle is like from steps (a) to (e) as below.

(a) Actuator is set to its minimum expansion (so ambu bag doesn't have any pressure on it)

(b) NEMA 17 motor start rotating and Actuator displacement happening towards ambu bag and start pressing it (see illustration for visual idea)

(c) NEMA 17 motor will stop for while (see below table to ideal time)

(d) Now NEMA motor start rotating in reverse direction; so, actuator start retracting and gradually releasing pressure from ambu bag.

(e) Actuator will be set to its starting position and ambu bag is completely non-pressurized.

All above five steps from (a) to (e) will be referred as one breath cycle; cumulatively each breath cycle should be completed in time as shown in table below.

Table 2: Functionality of Breath cycle potentiometer(B)

Breath cycle potentiometer(B) Functionality ** Assuming potentiometer has 360-degree rotation and virtually break down to 9 steps									
Degree of rotation	0-40	41-80	81-120	121-160	161-200	201-240	241-280	281-320	321-360
Virtual Step	1st	2nd	3rd	4th	5th	6th	7th	8th	9th
Breath Cycles / Minute	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
Inhalation time (Expansion of actuator)	1.50 Seconds	1.38 Seconds	1.29 Seconds	1.20 Seconds	1.13 Seconds	1.06 Seconds	1.00 Seconds	0.95 Seconds	0.90 Seconds
Hold/Pause (No movement of NEMA 17 and actuator)	0.30 Seconds	0.30 Seconds	0.30 Seconds	0.30 Seconds	0.30 Seconds	0.30 Seconds	0.30 Seconds	0.30 Seconds	0.30 Seconds
Exhalation (NEMA 17 start reverse rotation, retraction of actuator	3.20 Seconds	2.93 Seconds	2.70 Seconds	2.50 Seconds	2.33 Seconds	2.17 Seconds	2.03 Seconds	1.91 Seconds	1.80 Seconds
Cumulative time to complete 1 full cycle	**5.00 Seconds**	**4.62 Seconds**	**4.29 Seconds**	**4.00 Seconds**	**3.75 Seconds**	**3.53 Seconds**	**3.33 Seconds**	**3.16 Seconds**	**3.00 Seconds**