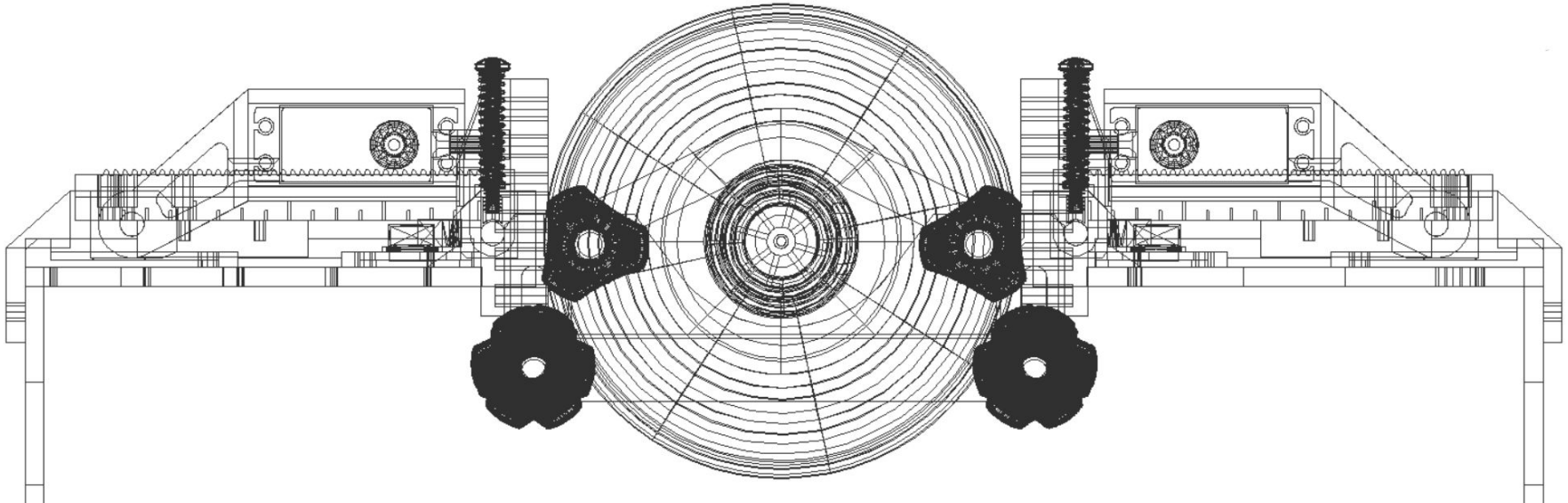
DEVELOPMENT OF LOW COST, MULTI-POWERED, MCU-BASED CORONARY CARE UNIT FOR VARIOUS MEDICAL USE IN BARANGAY PUTOL, BALAYAN, BATANGAS

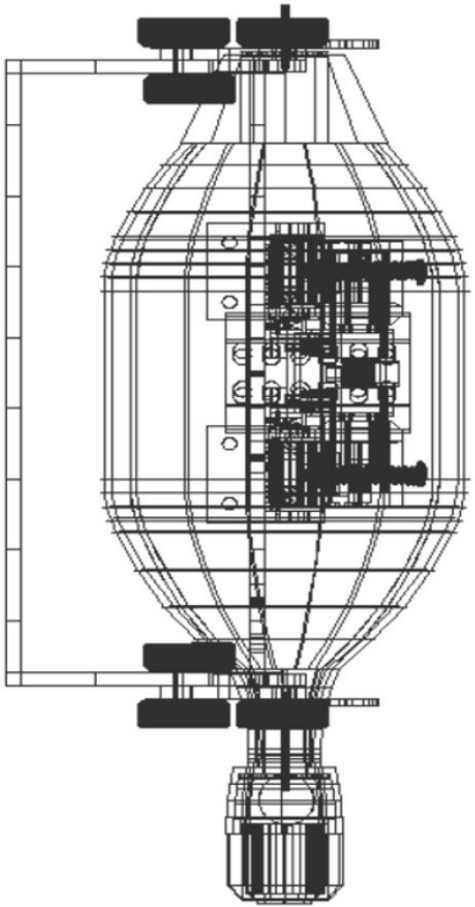
Proponents:

XXXX, XXXX X.
XXXX, XXXX X.
XXXX, XXXX X.

FABRO, JOHN REYMAR I.
XXXX, XXXX X.
XXX, XXXX XXX X.



THE ABSTRACT

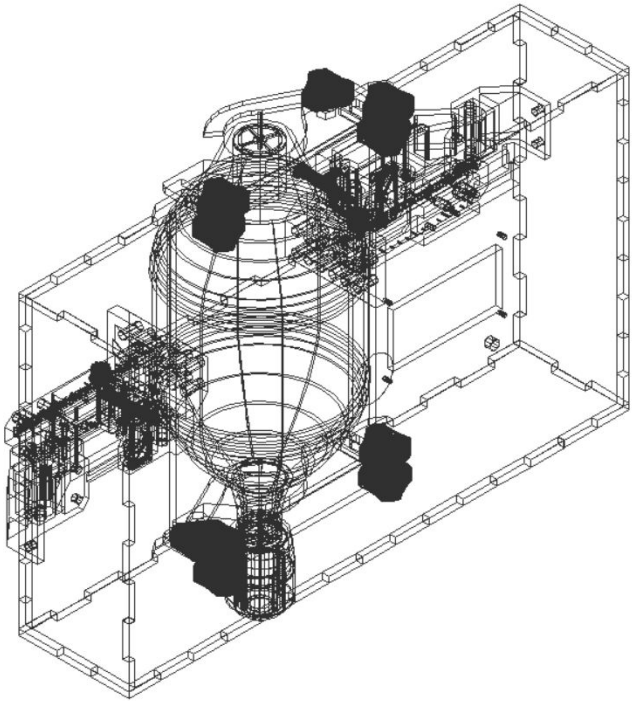


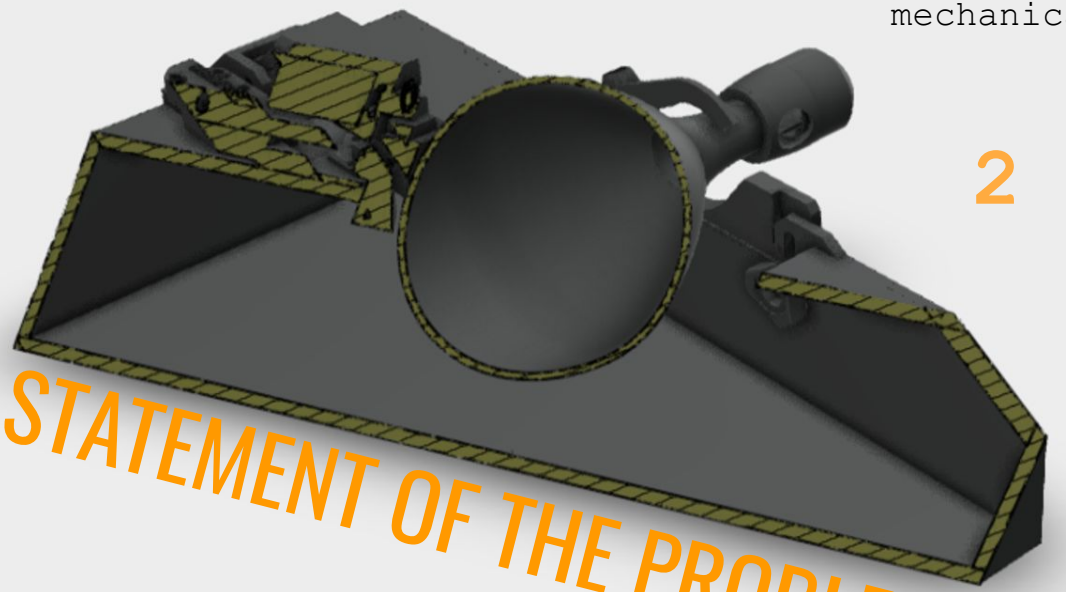
ABSTRACT

Accessibility to proper healthcare has been a constant struggle for developing countries like the Philippines. This is more apparent to challenged communities in rural areas that are far from the nearest hospital facilities, and in addition to that is its inconsistent supply of electrical utilities, especially worse during natural disasters. This research aims to design and develop a portable, low-cost, MCU-based coronary care unit ventilator system for various medical uses, to provide consistent ventilation from a non-invasive ventilator synchronized with the monitoring of heart rate and oxygen level of the blood from an oximeter to be able to lessen the impact of the heart disease and other related illness to improve their health. It will also be integrated with a secondary power source that utilizes solar energy to address the unreliable power in rural areas. Microcontrollers will also be utilized and implemented into the CCU to serve as a processing unit and make it low-cost. In order to test or assess the build, the device is subjected to different structured quality and performance tests with the help and supervision of medical professionals.

INTRODUCTION

- The Philippines registered its highest mortality rate in 63 years in 2021, with more than 760,000 deaths recorded.
- The Philippines as a disaster-prone country in Asia is naturally visited by typhoons even during the pandemic outbreak, worsening the condition of the already challenged community in the rural area.
- The coronary care unit (CCU) is intended for people that have cardiac health illnesses and other related illnesses.
- In the treatment of these cases, mechanical ventilators are essential even though it's not a cure of the disease but it plays a crucial role in extending the life of patients.





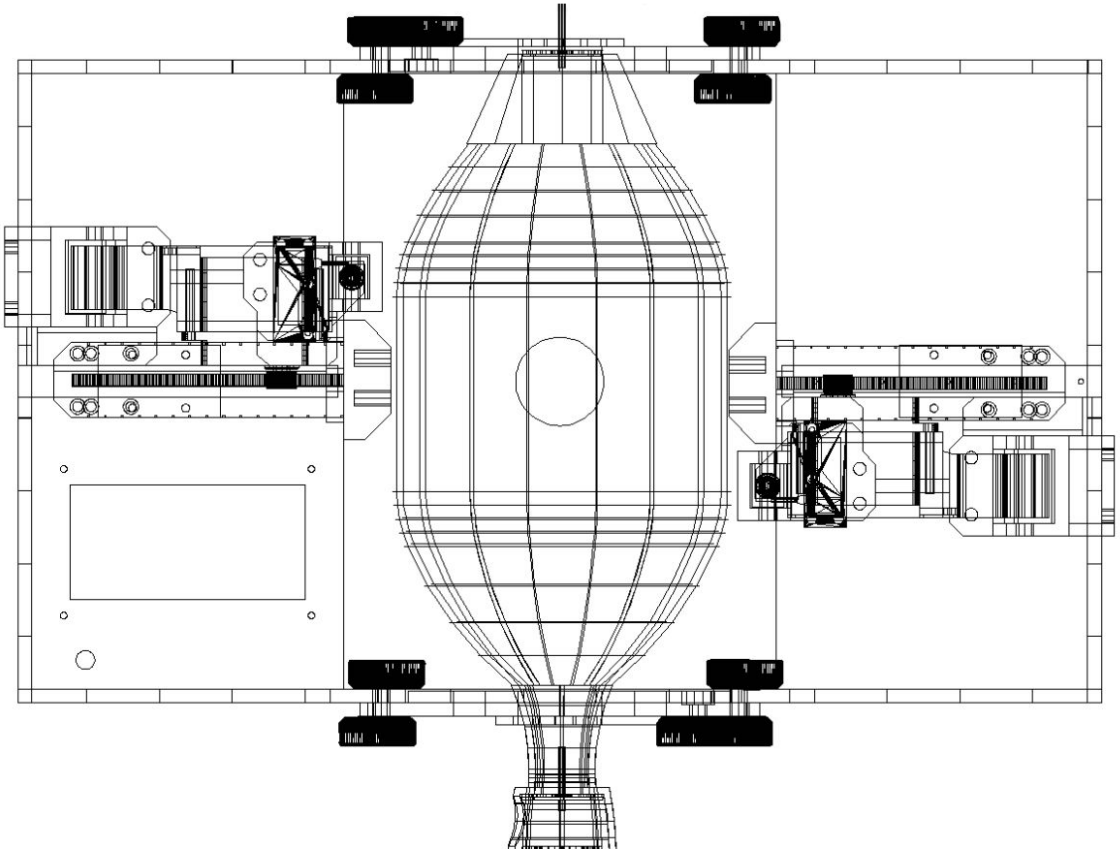
STATEMENT OF THE PROBLEM

1 What is the design of a low-cost, multi-powered, MCU-based CCU that will be used as an alternative to standard mechanical ventilators?

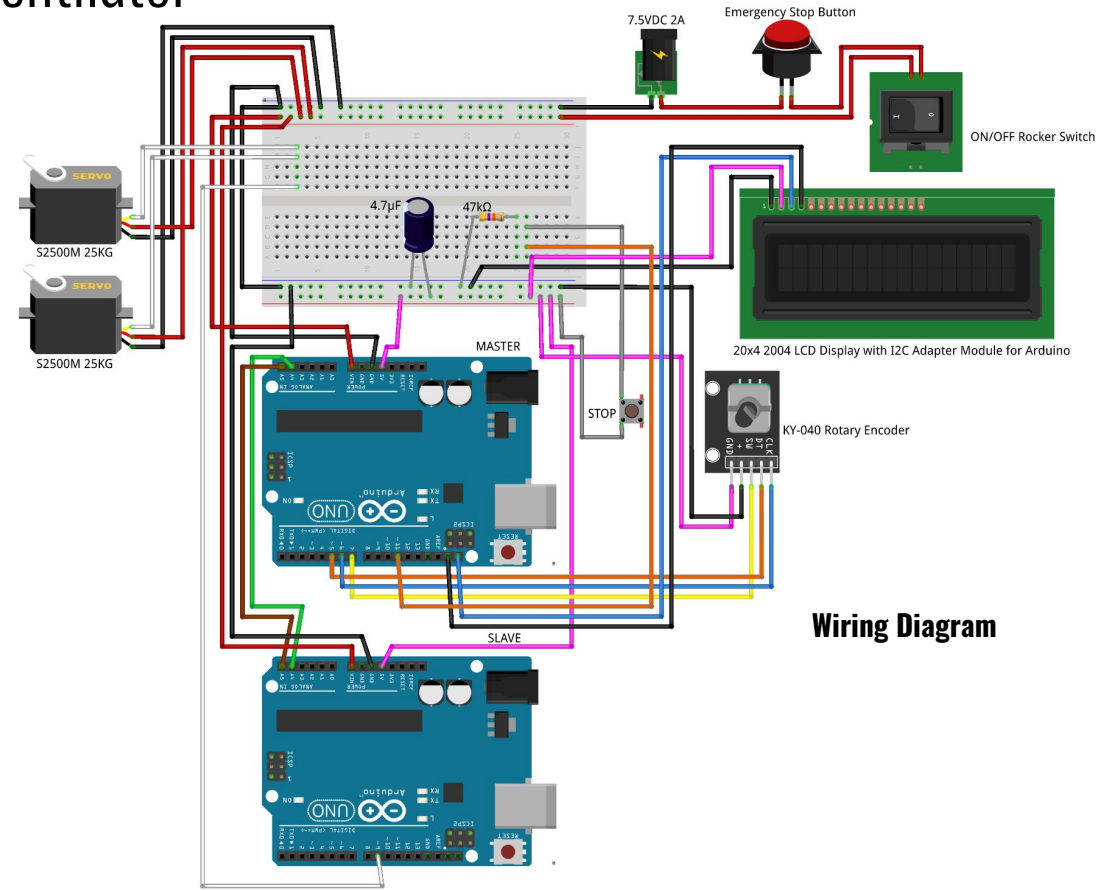
2 How does the portable, MCU-based device perform compared with the hospital-based CCU devices in terms of efficiency and accuracy?

3 How does the unit fare in terms of functionality and efficiency under different sources of energy especially in cases of emergency?

RESEARCH DESIGN

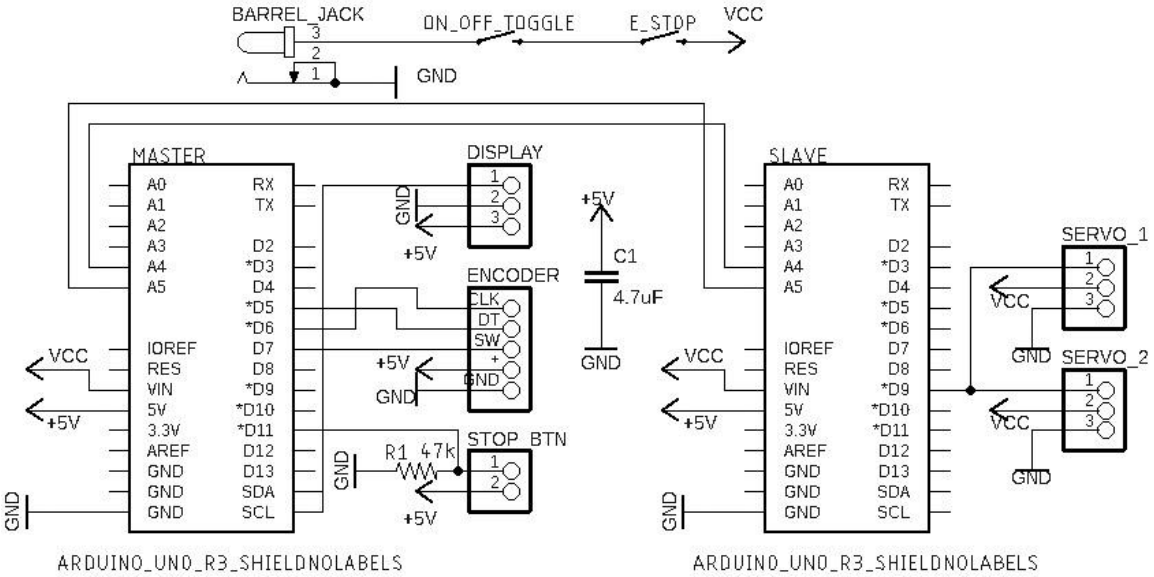


Mechanical Ventilator

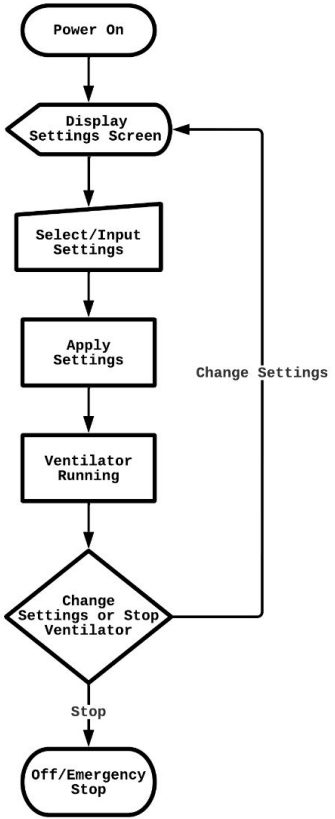


Wiring Diagram

Mechanical Ventilator

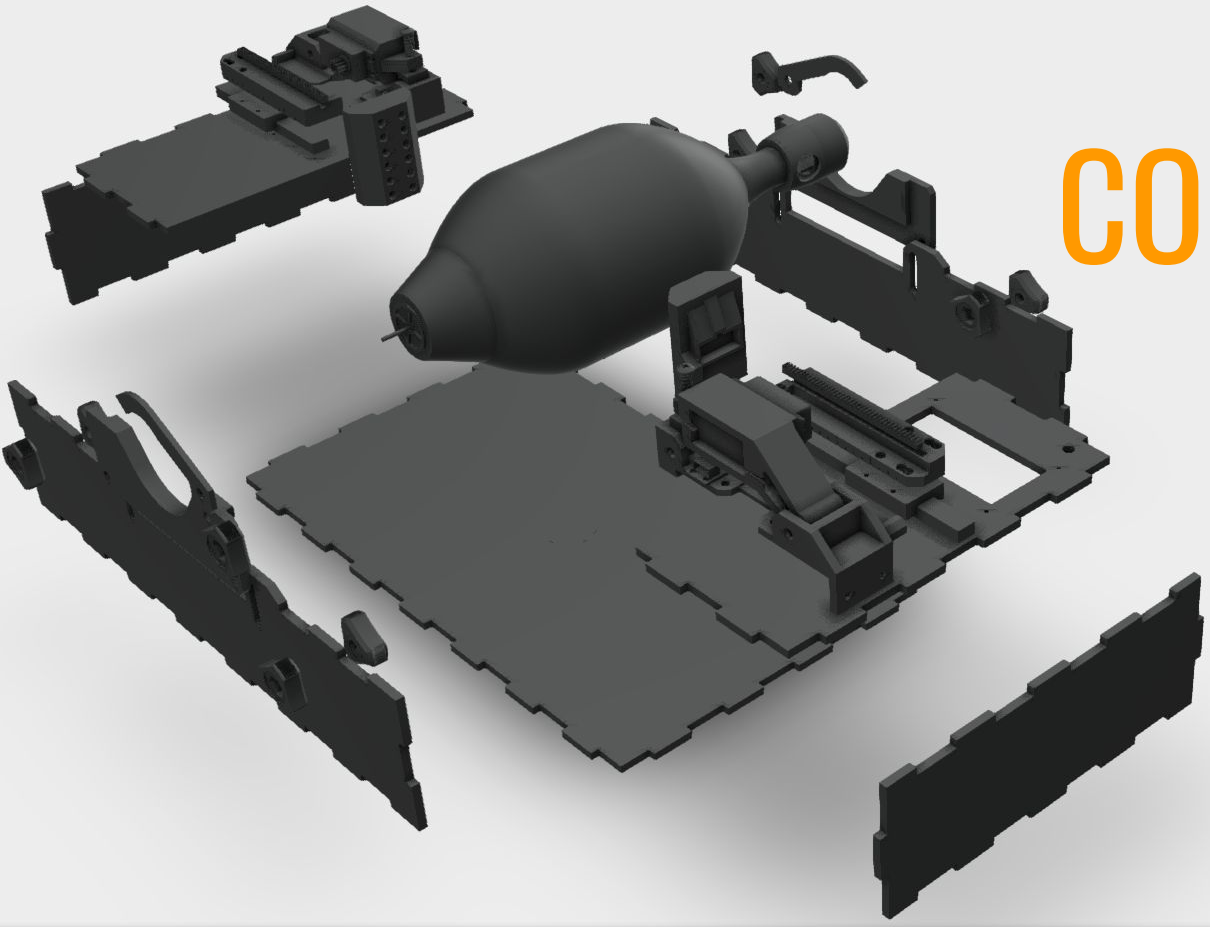


Diagram



Flowchart

PROJECT CONSTRUCTION

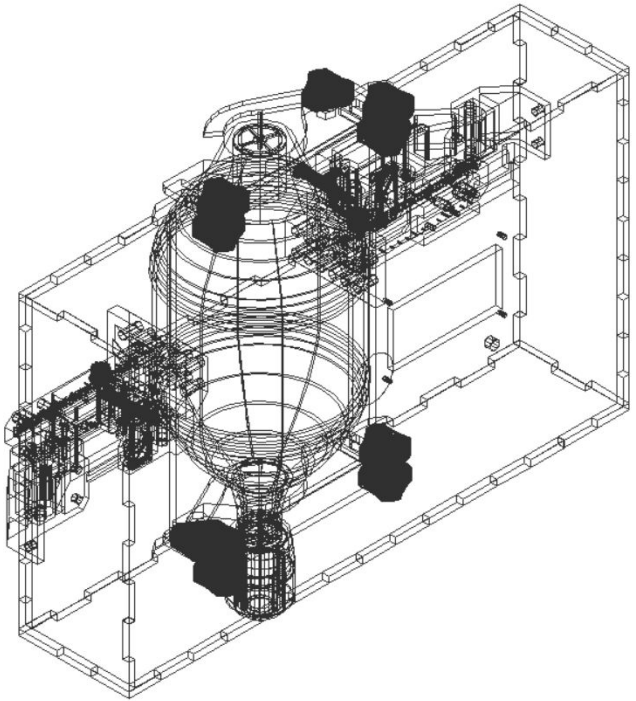


List and cost of materials

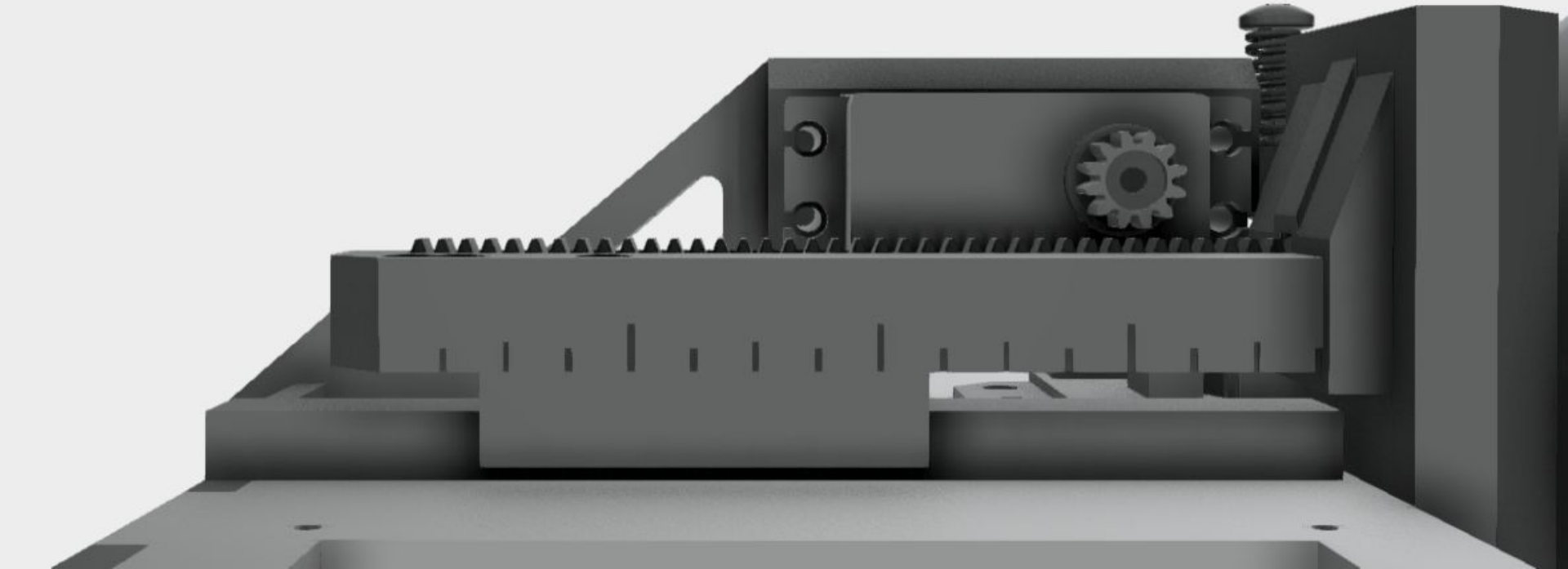
Ventilators in Hospital ICU's cost between PHP 1,500,000 and PHP 3,000,000.

The final cost of our prototype totals to:

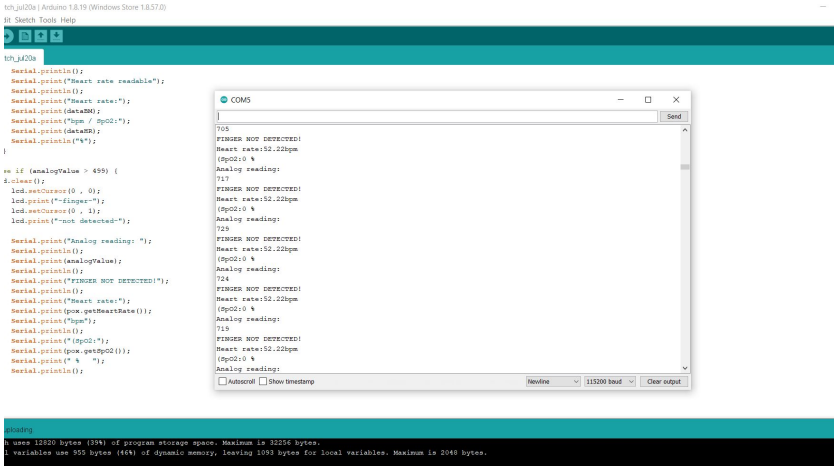
PHP 34,640.75.



TESTING AND EVALUATION



Pulse Oximeter Testing



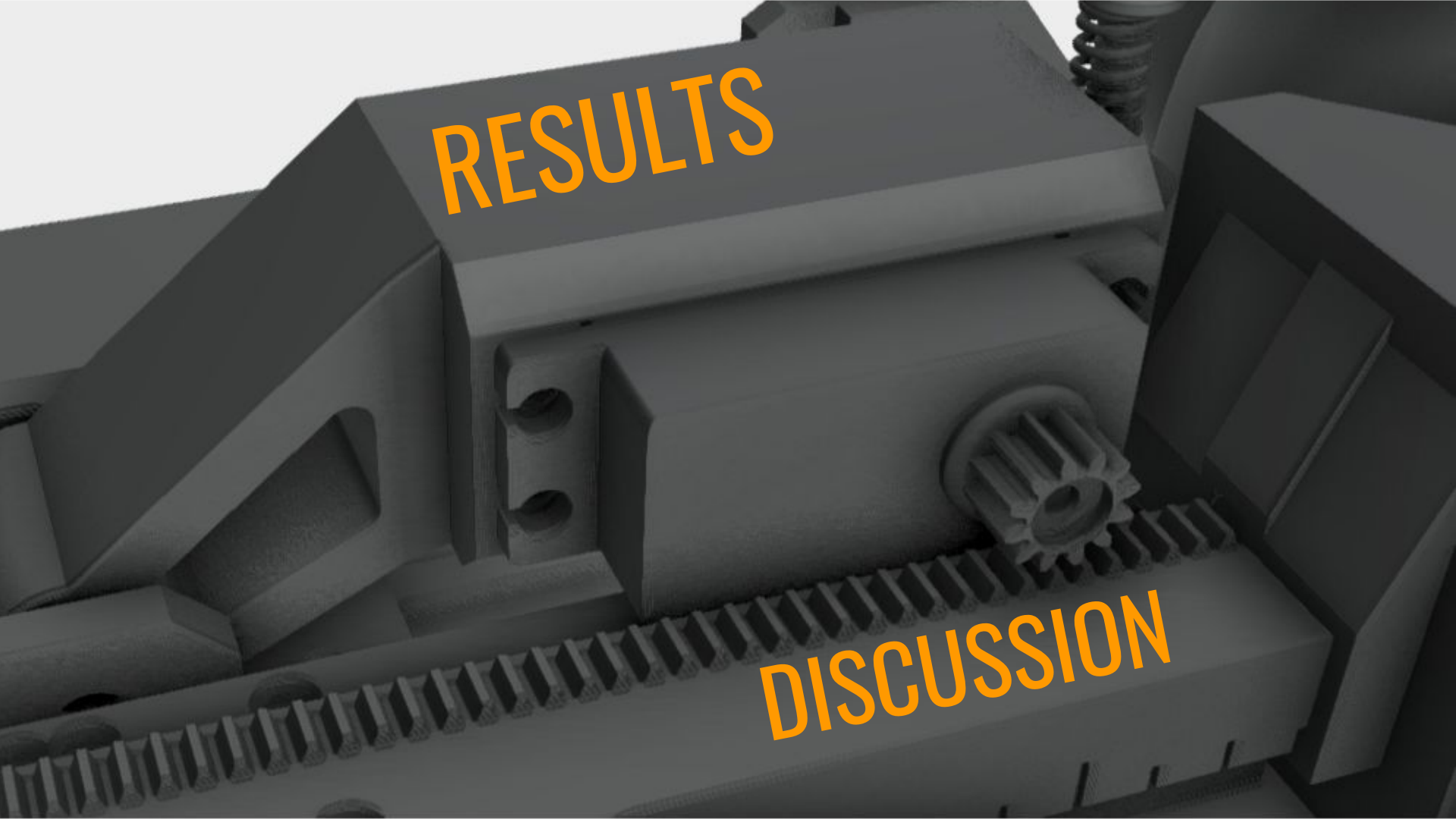
> MAX30102 pulse oximeter module and commercial pulse oximeter.

> The testing of the pulse oximeter module is to check the oxygen saturation and pulse rate in comparison with commercial pulse oximeter.

> The pulse oximeter module is equipped with light sensor to detect finger and start operation.

> Upon the detection of the beat from the module it is recorded with respect to time and then test the commercial in the same finger within 5 trials.

> The serial monitor from the Arduino IDE shows record of result that will be used and interpreted.


RESULTS
DISCUSSION

Data gathered using the Water Seal Spirometer:

Percentage of error values that are within +5% and -5% are acceptable values. 0.000 indicates the most accurate value gathered while values that are not within the range (x > 5% or x < -5%) are considered values that indicate inaccuracy of output with respect to its input.

TIDAL VOLUME – RAW									
Power Grid 7.5 V, 2A	I:E	1:3		I:E	1:3		I:E	1:3	
Tidal Volume Input	300 mL			600 mL			700 mL		
BPM Input	12	24	30	12	24	30	12	24	30
Trial 1	286	280	300	585	599	597	691	696	704
Trial 2	298	289	301	598	595	607	697	695	709
Trial 3	292	284	303	599	596	595	692	701	706
Trial 4	299	301	305	596	591	605	698	701	699
Trial 5	285	288	309	592	597	610	691	697	710

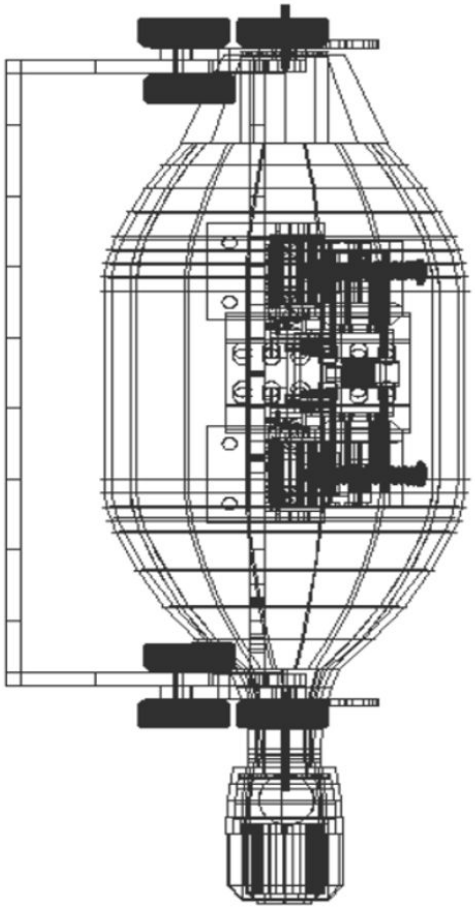
Table 4.1 *Raw tidal volume using the power grid (7.5V, 2A)*

PERCENTAGE ERROR									
Power Grid 7.5 V, 2A	I:E	1:3		I:E	1:3		I:E	1:3	
Tidal Volume Input	300 mL			600 mL			700 mL		
BPM Input	12	24	30	12	24	30	12	24	30
Trial 1	4.667	6.667	0.000	2.500	0.167	0.500	1.286	0.571	0.571
Trial 2	0.667	3.667	0.333	0.333	0.833	1.167	0.429	0.714	1.286
Trial 3	2.667	5.333	1.000	0.167	0.667	0.833	1.143	0.143	0.857
Trial 4	0.333	0.333	1.667	0.667	1.500	0.833	0.286	0.143	0.143
Trial 5	5.000	4.000	2.944	1.333	0.500	1.667	1.286	0.429	1.429

Table 4.2 *Percentage of error using the power grid (7.5V, 2A)*

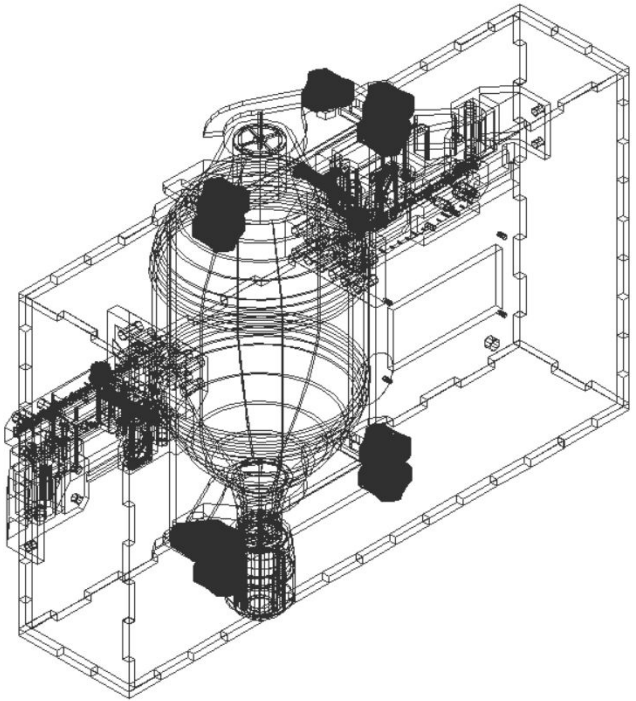
Data shows a marginal error that is consistently less than +5% and greater than -5% throughout the experimentation implemented. This shows accurate results.

SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS



Summary

- The development of the CCU device integrated with multiple sources of power has complied with the research objectives that was stated.
- The solar panel has helped the device to run for longer time added adaptability.
- The device’s ability to be portable will be a big help to rural communities.



THANK YOU FOR LISTENING !