Project proposal

**Problem Statement**

There is a huge shortage of ventilators in India. In case of an outbreak to save lives of hundreds or may be thousands the country needs to have ventilators or alternatives which can save lives of people. According to a report , there are 2.3 ICU beds per 100,000 for a 1.3 billion population. So we need to fill the gap.

**Solution: Low Cost Fully Automated Bag Valve Mask**

As we know there BVM can be an alternative for tackling this situation. Automated BVM can help the patients to survive. Solution we propose:

1. To make a Low Cost Portable Ventilator using BVM
2. It can be controlled and monitored using Computer and Mobile seamlessly.
3. Single Operator System (An operator can control as well as monitor 5 patients at a time from his computer)
4. Alerting doctor in case of emergency
5. And to make it fail safe we can use a backup battery pack (i.e. 7AH 12V battery which is enough to run the system for 30+ days on a single charge)

**Benefits**

1. If the patient’s condition is particularly fragile, the monitor will be set up to send an alarm to the caregiver, indicating an increase in air pressure.
2. It also helps the patient’s body to heal, since it eliminates the extra energy of labored breathing.
3. This will reduce the doctors workforce on a single patient
4. Some of the essential parameters can be monitored and also controlled using a PC or Mobile device.
5. Doctors will be instantly notified if any anomaly happens.
6. Data is stored in the Cloud and in local server

**Deliverable/Project management**

1. First we will need to list the demand and the hospital requirements. The production mainly depends on supplies. It is estimated that one 3D printer takes upto 5-6 hours to make the frame of the product. So the production speed totally depends on the number of 3D printers. One 3D printer can print 4 ventilator frames in one day and 28 in weeks. If we have 10 3D printers the production rate will increase by 900%.
2. As the printing parts are done, the sanitization process will take place and then the assembly line will assemble every part.
3. Then product deliveries will happen according to the priorities.
4. IoT will help to analyse risk analysis and risk management. This will help to instantaneously change the product when any error occurs.
5. The support team will be alloted to ensure safety of patients and the hospital requirements.
6. To ensure constant flow of production we need to have multiple suppliers and the 3D printing communities contacts. Which will help in good supply chain management.

**Planning Process**

1. Build the device model, using stepper motor, 3D printed mechanical hand, Ambu bag and a respiration pipe.
2. Connect a flowmeter to the respiration pipe.
3. Connect stepper motor and flowmeter to the microcontroller.
4. Study the analog values of flowmeter due to different range of motions of the mechanical hand by the stepper motor using the microcontroller.
5. Calibration is done based on flow meter readings- which tells us how much movement of the mechanical hand delivers how much volume of airflow through the respiratory pipe.
6. Gathered data is used to generate a virtual regulator on a dashboard and flowmeter is removed. Now the value can be set through an online dashboard by a supervisor.
7. Now work on the dashboard and IoT system is started, so that it becomes possible to control 'n' number of such devices from a single online dashboard.
8. Integration of the ECG sensor module to the microcontroller. The ECG data is also exported to the dashboard and can be viewed by the supervisor.
9. Study of critical situations and integration of an auto alarm system based on ECG data parameters using generated threshold values.
10. Making of marketable final package and delivery for clinical testing.

**3D Model View:** [**https://drive.google.com/file/d/1IG3OpgUENjST5TU6rJ6GabznYoLv\_c6q/view**](https://drive.google.com/file/d/1IG3OpgUENjST5TU6rJ6GabznYoLv_c6q/view)

**Budget Estimation**

This is the simple budget for making one unit of the device.

| **Items** | **Number of items** | **Cost per item** | **Total cash cost** |
| --- | --- | --- | --- |
| Ambu Bag | 1 | Rs.1400/- | Rs.1400/- |
| Arduino Mega | 1 | Rs.2599/- | Rs.2599/- |
| NodeMCU | 1 | Rs.435/- | Rs.435/- |
| Stepper Motor (10Kgcm Torque) | 1 | Rs.1235/- | Rs.1235/- |
| 3D Printed Parts |  | Rs.20000/- | Rs.20000/- |
| Acrylic Enclosure | 1 | Rs.2000/- | Rs.2000/- |
| ET Tube and Peep Valve | 1  1 | Rs.226/-  Rs.1300/- | Rs.226/-  Rs.1300/- |
| 7AH Lithium Ion Battery | 1 | Rs.1000/- | Rs.1000/- |
| ECG Module (AD8232) | 1 | Rs.1240/- | Rs.1240/- |
| Servo Motors | 1 | Rs.6000/- | Rs.6000/- |
| 10K Potentiometer | 1 | Rs.130/- | Rs.130/- |
| Stepper Motor Controller IC (A4988) | 1 | Rs.128/- | Rs.128/- |
| Total (Estimated) |  |  | **Rs.26443/- \*** |

**Contacts**

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