The Institution of Engineering and Technology

Ventilator Tracking for COVID-19 Preparedness

A concept note by the IET Healthcare Working Group

The Institution of Engineering and Technology (The IET) is a professional society for engineers headquartered in the UK. We turn 150 this year and our vision is to engineer a better world.

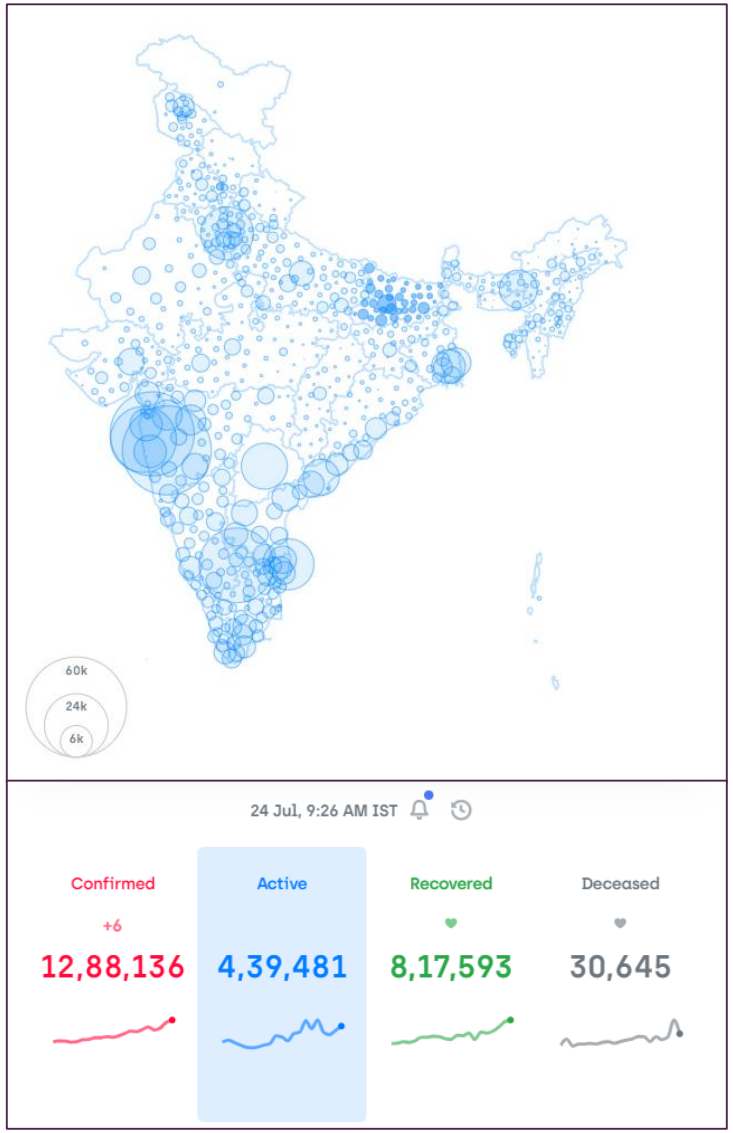
We are neutral, credible platform that brings together to solve societal challenges. In response to the COVID-19 pandemic, expert volunteers from the IET's Healthcare Working Group have put together this document to propose a quick and effective solution for tracking ventilator availability in the country.

Goal

(in the current Covid-19 scenario)

Assist the government in fighting the Covid-19 pandemic by ensuring equitable critical care for those in need

1. Dashboard: Tracking / Monitoring ventilators supplied to states
2. Quick, Easy and Minimalist Solution, Deployment and Maintenance



Metrics

1. Location:
    - Live tracking of the ventilator movements to ensure availability in the intended location.
    - This will ensure fair distribution of devices based on the need.
    - Alerts accumulation of the devices at a single place.
2. Utilisation:
    - Usage pattern based on how long it was powered on.
    - Alert if something is not getting used for certain period of time.

Constraints / Considerations

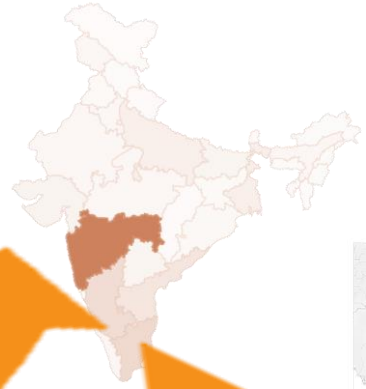
- “No-Contact” solution
- “No/minimal” effort for data collection.
- Option to Integrate with existing state level platforms.
- Design for “Easy & Rapid Scalability” for pan-India implementation.
- “No/minimal” Infrastructure requirement based on the options chosen.

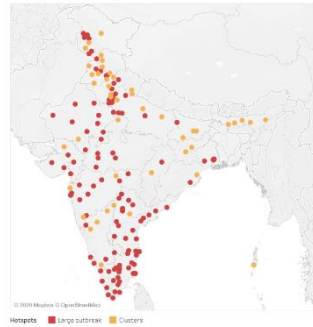
Option #1

(No hardware & minimal data collection effort)

System Design #1

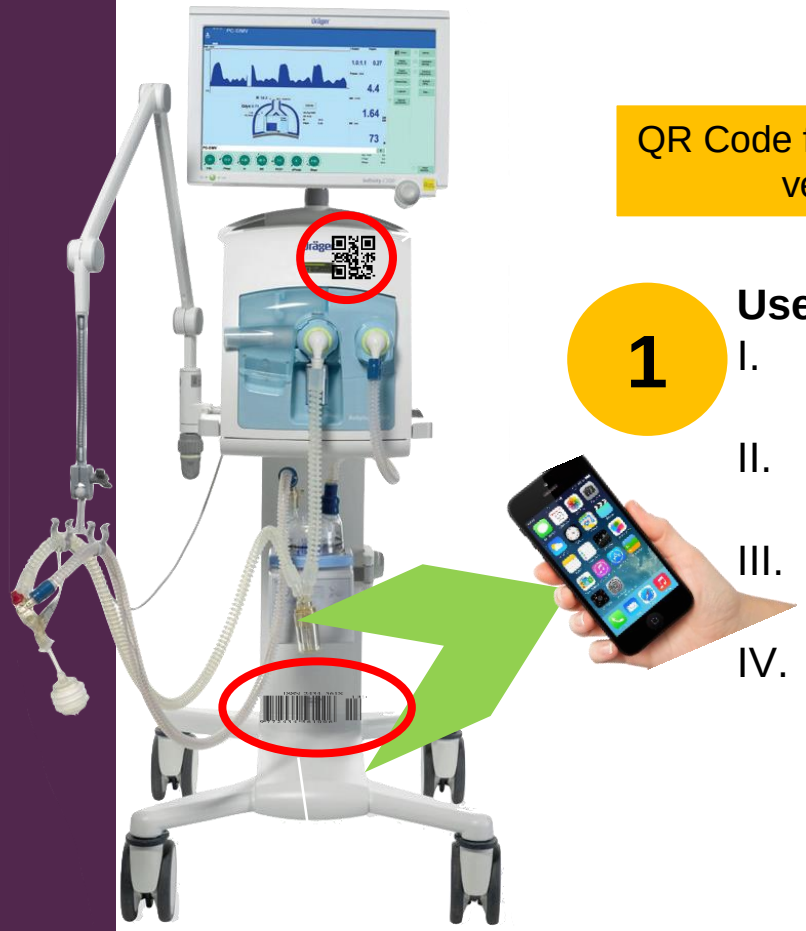
- Serial # matching
- Dashboard creation.
- Image processing.
- QR code – Ventilator mapping
- Ventilator database





- Initial Setup
  - User Setup
  - Serial # scan
  - QR Code generation
- Utilization scan
- Data acquisition

Ventilator & User Registration



QR Code for identifying the ventilator.

Serial number / Barcode of the manufacture

1

User & Device Input

I. Open the device registration App page.
II. Fill the one time survey Qs (user name, facility etc.)
III. Scan the Barcode of the device serial number.
IV. Submits it

2

Back-end Registration:

I. App sends the details & location to the server.
II. Date of registration is stored.
III. Serial # is matched with the database
IV. GPS location is registered.
V. QR Code is generated and sent to the APP & Email.

3

Device is tagged:

I. The QR code is printed.
II. QR code is pasted at a location where picture can be taken along with the screen.

Data acquisition workflow

1

Patient Arrives and the ventilator is turned-on

I. Open the App.
II. Take the photo of the screen of the ventilator with QR code.

2

Data acquisition: START

I. App reads the QR Code.
II. Screen Capture of the Ventilator (ON)
III. Date and Time stamp of the capture.
IV. GPS location of the mobile device
V. User ID/Mobile ID of the person taking the picture
VI. Uploads the data to the central cloud

3

Patient discharged and the ventilator is turned-off

I. Open the App.
II. Take the photo of the screen of the ventilator with QR code.

4

Data acquisition: END

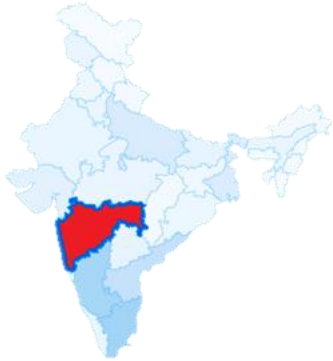
I. App reads the QR Code.
II. Screen Capture of the Ventilator (OFF)
III. Date and Time stamp of the capture.
IV. GPS location of the mobile device
V. User ID/Mobile ID of the person taking the picture
VI. Uploads the data to the central cloud

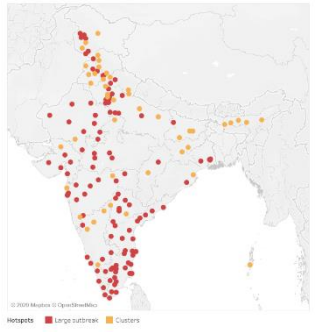
Dashboard

1

Phase #1:

I. Available Inventory & its location.
II. Distribution of the devices across the country.
III. Device movement & tracking. (with alerts)
IV. Utilization of the devices
   - How many days. (with alerts)
   - How long per day (with alerts)



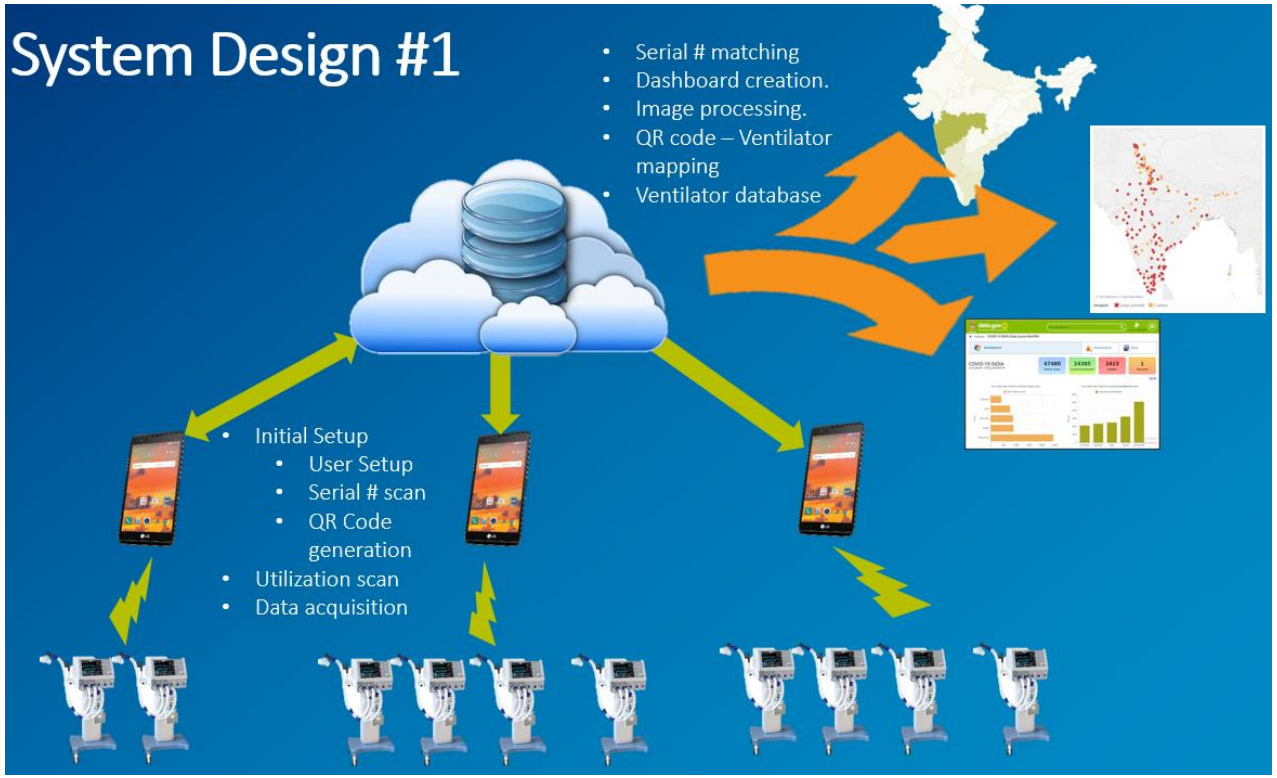


2

Phase#2:

I. Fair distribution of ventilators by matching the COVID data with location of the devices.
II. Image processing to do audit on usage pattern.
III. Image processing to check adherence to the prescribed process.
IV. With MRN # and some basic details we can now make data available for research like age category, patterns etc.
V. Patient Footfall in ICU
VI. Creation of the vendor support channel based on the device location.

Conclusion



Advantages:

I. Rapid mobile APP development.
II. Can onboard users immediately after the lunch.
III. Can be lunched at a scale (Pan India)
IV. Data Collection effort is distributed.

Disadvantages:

I. Minimal but additional effort.
II. Some amount of training is required.

Option #2

(Minimal Hardware, No data collection effort)

GPS Enabled SIM Based smart plug

The smart GPS Enabled Plug

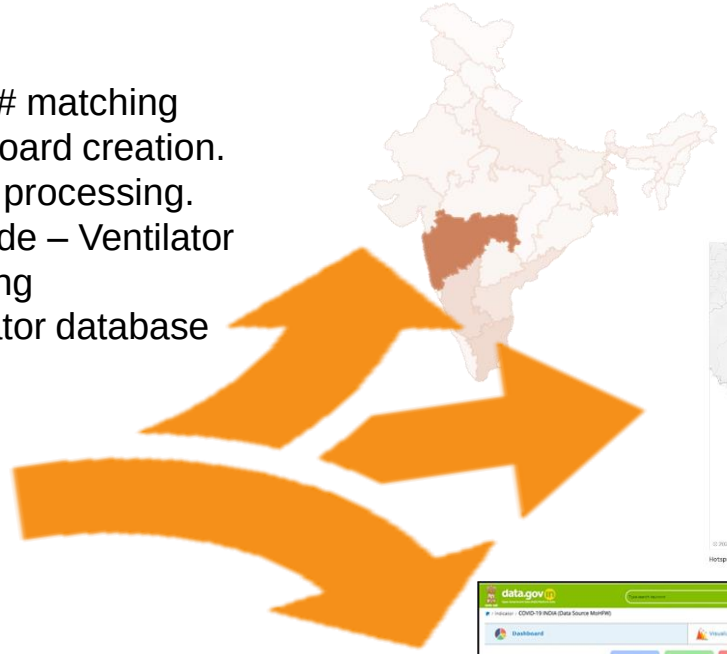
I. The smart plug will be placed on top of the current power source.
II. Power-ON will power both Ventilator & GPS tracker.
III. The tracker will share its location to the backend.

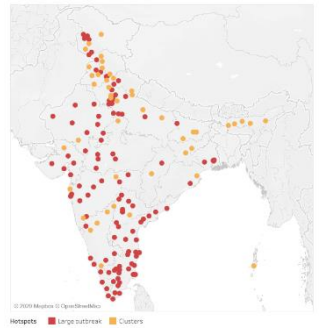
Benefit:

- Every time the backend server receives data will infer that the device is used at a certain location.
- This will give location & Usage details.

System Design #2

- Serial # matching
- Dashboard creation.
- Image processing.
- QR code – Ventilator mapping
- Ventilator database





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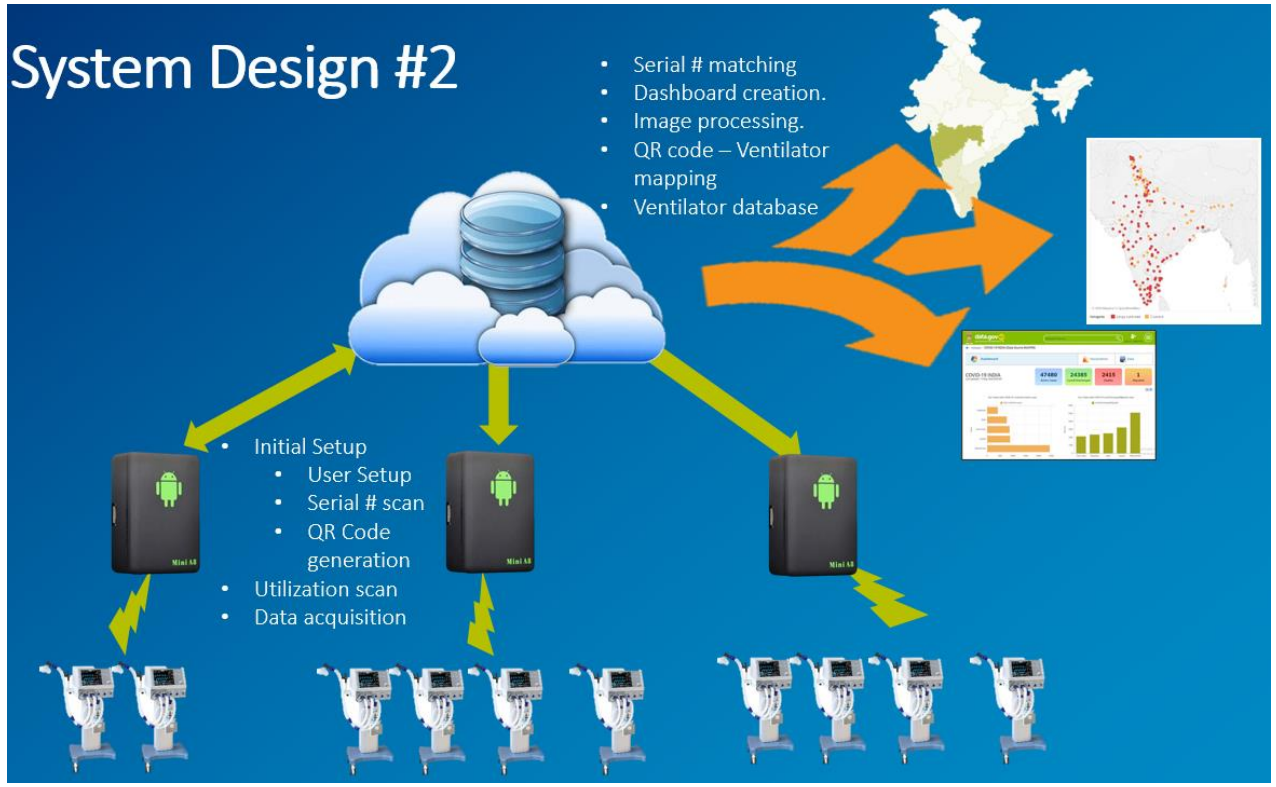

Advantages:

I. Rapid mobile APP development (registration)
II. Absolutely **NO** effort from the caregivers.
III. Just have to power on the ventilator.

Disadvantages:

I. Hardware design & supply.

Combined Option (Redundant & Backup System)

(Minimal Hardware, Minimal data collection effort)

Combined Option

Advantages:

I. Can be lunched Pan India after the APP is ready.
II. Can onboard users immediately after the lunch.
III. Will get time to slowly supply smart plug to all locations.
IV. Once facility has smart plug there onwards absolutely **NO** effort from the caregivers.
V. Can work as a backup system for any eventualities. Such as GPS signal loss, broken plug etc.

Capital Expenditure on a high level

Option#1

I. App Development
II. Cloud hosting
III. Interoperability
IV. Training needs
V. Change Management

Option#2

I. App Development (Registration)
II. Cloud hosting
III. Interoperability
IV. Smart Plug Design & Manufacturing
V. Shipping charges
VI. SIM Card cost
VII. Training
VIII. Change Management

	Item	Days			
App					
	registration	30			15600
	scanning	10			5200
	daily report	20			10400
	Admin	20			10400
	QR Code mgt	10			5200
Cloud					0
	Registration	15			7800
	Daily scan	15			7800
	Help/Support	15			7800
	Setup	15			7800
					0

Credits

The concept presented in this document has been curated by Ravi Ramaswamy, Senior Director – Philips Innovation Campus, Bangalore (Chair, Healthcare Working Group, IET Future Tech Panel) and his team including Debabrata Parida, Ganesh Natarajan, Abhijeet Landge, Satyam Kumar, Madhusudhan Karupakula and Suju Krishnan.

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