

DEVELOPMENT OF A SMART AIR FILTRATION SYSTEM TO CONTROL COVID-19 TRANSMISSION IN HOME ENVIRONMENT

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Introduction:

Many patients around the world face the problem of being denied quality health care due to the unavailability of basic facilities at a hospital. One such problem which was seen in common during the covid pandemic was the availability of hospital beds. In a few situations, people were being unnecessarily admitted, which resulted in delays in care and eventually the development of complications. The pandemic showed us that our medical infrastructure is not up to the mark and was not able to keep up with the number of cases during the peaks of COVID-19.

To overcome this situation the need to Design, Develop and Fabricate a low-cost sophisticated bed is required that would turn out to be a major breakthrough if carried out in a large scale for use in hospitals. It will help the patient to set-up a hospital standard equivalent bed at his/her home from which a doctor can monitor the patient 24*7. The bed is designed in such a way that the suction pipe sucks the exhaled air of the COVID-19 patient and passes it through a pipeline into containers filled with hot water or hot oil maintained constantly at 80 degrees Celsius. The system also monitors the patient's health condition and keeps the nurses and doctors updated with the information of the patient's health conditions through the camera fixed.

Objectives:

1. To study the design aspects of the bed and to analyse the efficient way of treating the patients through this product.
2. To develop a smart bed based on the field research carried out.
3. To conduct an evaluation of the developed bed.
4. IoT integration to it is being planned and is in process to implement it to make the product smart.

Methodology:

1. Literature study: Review made on other models present in the market and focusing on how to make the design simple
2. Conceptual design: Sketching several types of design based on concept that being choose
3. Materials Selection: Selection of true materials based on model design and criteria. Light, easy to joining and easy to manufacture.
4. Fabrication model refinement: Fabrication done according to the main frame and design and refinement being done on the sharp edges and height adjustability of the bed

Materials Used:

Steel tubing for the fabrication of the bed, DC motor to control the movement of the filtration system, DC ceiling fan to suck the infected air, water heater to heat the water and oil through which the sucked air flows and the viruses killed, Arduino & MPU6050 as the main electronics system to create virtual circuits and form link between the different components, 5V dual channel relay model, face detection camera to detect patients movement and a lead-acid cell as the power source.

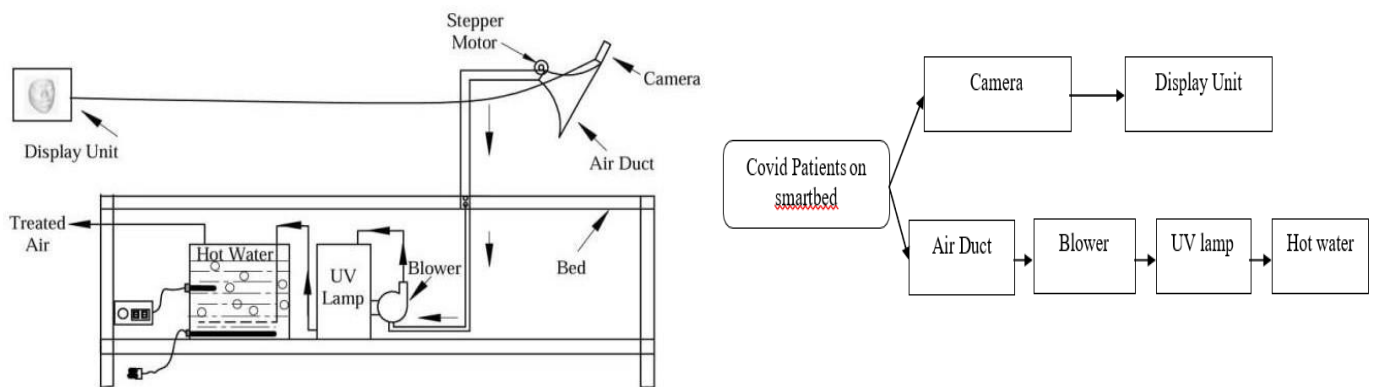


Figure Schematic of the COVID-19 Hospital Bed

Conclusion:

The COVID-19 bed is a multipurpose, smart, foldable system with an oximeter, suction pipe and a face recognition camera. This bed is designed in such a way that the suction pipe sucks the exhaled air of the COVID-19 patient and passes it through a pipeline into containers filled with hot water and hot oil maintained constantly at 80 degree Celsius. A face recognition camera is fixed to the system, which recognizes the patient's face movement and helps the system move in the same direction as that of the patient.

We have developed a low cost sophisticated bed that would turn out to be a major breakthrough if carried out in a large scale for use in hospitals.

The bed is light and capable of withstanding weight more than human average weight while also being easy to setup. The bed will help the patient to set-up a hospital standard equivalent bed at his/her home from which a doctor can monitor the patient 24*7.

It is less expensive method to have same treatment as a hospital but at home as it saves the hospital charges as well. The filtration of air is simple yet very effective and kill all the viruses and microbes breathed out. It is safe to use in family environment as it prevents the risk of cross contamination which, in hospitals the risk of cross contamination is very high due to improper filtration of patient's exhaled air

Scope for future work:

1. Improving the design of the smart air filtration COVID bed and incorporating material that is light, strong and cheap
2. Designing a foldable version of the product so that it can be stored away easily when not in use
3. Improving the components used for the suction mechanism so that higher efficiency obtained
4. Making the system completely smart with higher implementation of IoT
5. This prototype can further be modified by incorporating other medical devices like pulse oximeter, oxygen mask, a holter monitor machine etc., which can all be IoT based so that patients vitals can be monitored from anywhere
6. A SOS button can also be provided to be used by the patient in case of emergency which alerts all the emergency contact people with a text alert
7. Motor operated height adjustability and including more degrees of adjustability so that patient can be comfortable