

AUTOMATED NEBULIZER AID USING SPIROMETER FOR LUNG DISORDERS

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Abstract – Nowadays there is an enormous amount of diseases spread over the present and past are respiration diseases. In an existing way, the lung volume has been analyzed by Spirometers and then the patient will get the normal respiration by nebulizer on relevant to their respective lung volumes. The two various types of respiratory diseases which may leads to cause death is Chronic Obstructive pulmonary Disease (COPD) and Asthma. By the development of nebulizer mechanism and spirometer instead of monitoring and then delivering the drug, we have introduced the system that consists of spirometer, nebulizer and the microcontroller in the combined and automated manner. The ratio of FVC/FEV₁ (Forced Vital Capacity and Forced Expiratory Volume in one second) is considered as the breathing levels of the patient. It will progress the program which has been coded onto the microcontroller with the referred values of normal lung volume levels. Hence the drug has been delivered with respect to the patient’s lung volume stages by the pneumatic cylinders that contain the drug and deliver to the patient.

Keywords: Aerosol, LDR, Nebulizer air pump, Pneumatic Cylinder, Spirometer.

1. INTRODUCTION

A spirometer is a vital tool in the measurement of lung functions. It diagnoses, manage and treat a patient with any lung disease including asthma and COPD (Chronic obstructive Lung Disease: emphysema and chronic bronchitis). Most children by five years of age can perform a spirometer. Diagnosing asthma early at its onset is very important in helping reduce the patient’s lung disability. Monitoring someone with asthma and COPD with a spirometer can inform a physician on

when to increase or even when decrease medication. In this paper, a nebulizer is a drug delivery device used to administer medication in the form of mist inhaled in to the lungs. Nebulizers are commonly used for the treatment of asthma, cyclic fibrosis COPD and other respiratory disease or disorders. Pulmonary function test (PFT) plays a crucial role in the diagnostic evaluation of patients with various lung diseases such as obstructive airways diseases, restrictive lung diseases, neuromuscular disorders, vocal cord disorders and upper airways obstructions. Spirometer is the most commonly used instrument in the PFT laboratory. Recent evidence shows that nebulizers are no more effective than Metered-Dose inhalers (MDIs) with spacers. An MDI with a spacer may offer advantages to children who have acute asthma.

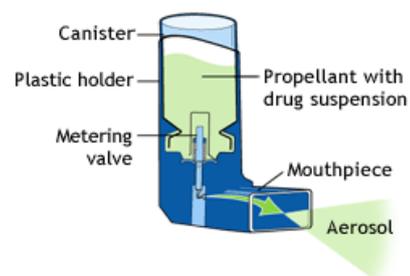


Figure 1: Metered Dose Inhalers

The lung deposition characteristics of an aerosol depend largely on the particle or droplet size. For very fine particles below 0.5 micrometer in diameter there is a chance of avoiding deposition of particles in the lung. It has been shown that when not cleaned and maintained well, nebulizers may be

colonized with pseudomonas species, staphylococcus aureus, pseudomonas aeruginosa, bacillus cereus and B.cepacia. However, maintenance of nebulizers in the diagnostic arena is imperative. An automated nebulizer aid is used to deliver the drug through the source of an air pump through the pneumatic cylinder to the patients.

1.1 MEASUREMENT OF SPIROMETRY

Spirometry is performed by deeply inhaling and forcefully exhaling into a spirometer is called the Forced Vital Capacity (FVC). Forced expiratory volume-one second (FEV1) is a measure of how much air can be exhaled in one second following a deep inhalation. The ratio of FEV1/FVC ratio is considered. For example, if the FEV1 is 4 and FVC is 5, then the FEV1/FVC ratio would be 4/5 or 80%. This means that the individual a breathe out 80% of the inhaled air in the lungs in one second.

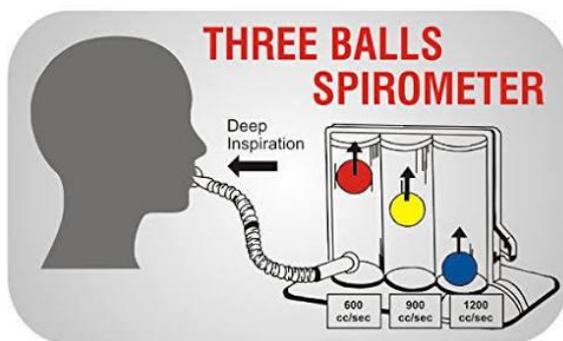


Figure 2: Spirometer

The three key spirometry measurements (the FVC, FEV1and FEV1/FVC ratio) for a given individual are compared o the reference values. The reference value is based on healthy individuals with normal lung function that would be expected for someone of the same sex, age and height. If the F and the FEV1 are within 80% of the reference value, the results are considered as normal.

Nebulizer will provide the drug to the patient at an appropriate level according to the breathing conditions of the patients having lung disorders. It delivers the drug to the patient by receiving the command from the PIC16F877A (Microcontroller) which may consists the program coding with respect the patient lung volume stages and then the pneumatic cylinder will delivers the drug according to the patients lung volume. By the help of relay driver, the nebulizer motor will turns ON and sets to OFF condition whenever the relay driver turns OFF. Nebulizers are highly efficient and

so it is preferable than Metered-Dose Inhalers (MDI) especially for children.



Figure 3: Nebulizer

The normal value for the FE1/FVC ratio is 70% (and 65% in persons older than age 65). When compared to the reference value, a lowered measured value corresponds to a more severe lung abnormally.

1.2 LEVELS OF THE STAGES

There are certain levels of the breathing stages which determine the lung diseases are classified as three stages such as mild, moderate and severe.

SPIROMETRY TEST	NORMAL	ABNORMAL	
		Mild	Severe
FVC and FEV1	Equal to or greater than 80%	Moderate	70-79% 60-69% Less than 60%
FEV1/FVC	Equal to or greater than 70%	Moderate	60-69% 50-59% Less than 50%

Table 1: Levels of the Stages

2. METHODOLOGY

2.1 BLOCK DIAGRAM

The proposed system is designed to provide solution for the drawback of existing system.

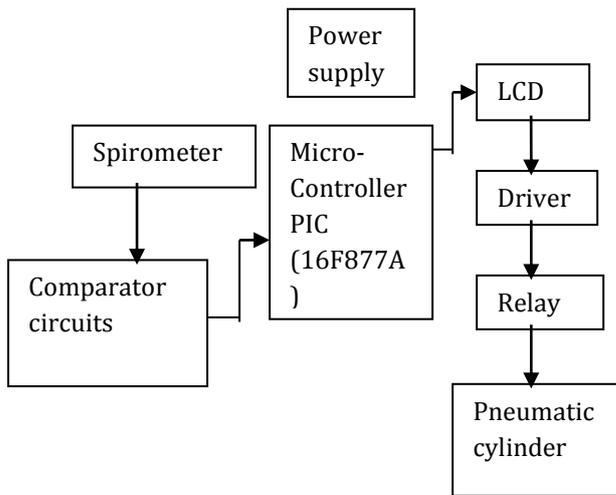


Table 2: Block Diagram for Proposed System

2.1 POWER SUPPLY

Power supply is a source of electrical power. A device that supplies electrical energy to an output load or group of loads is called a power supply unit or PSU. It can be broadly divided into linear and switching power supplies. The linear supply regulates voltage in low efficiency and switched mode supply has same rating as a linear supply will be a smaller is usually more efficient and complex.

2.2 TRANSFORMER

The conversion of AC electricity from one voltage to another is called transformer. Step-up transformers increase voltage, step-down transformer decreases the voltage. Mostly the step-down transformer has been used to reduce the dangerously high mains voltage (230V) to a safer voltage. A step-down transformer has a large number of turns on its input coil which is connected to the high voltage main supply, and a small number of turns give a low voltage supply.

2.3 LDR SENSOR

Light dependent resistors or LDRs are used to detect the presence or the level of light. It is a component that is sensitive to light. When light falls upon it, the resistance will be changed. Value of the resistance of the LDR may change over many orders of magnitude the value of the resistance falling as the level of light increases. It is made by the material called, cadmium sulphide (CdS).

2.4 COMPARATOR

Comparator is a circuit that compares two input voltages called the reference voltage (V_{ref}) and the input voltage (v_{in}). When v_{in} rises above or falls below V_{ref} the output changes polarity (+ becomes -) the comparator relies on the very high open loop gain of the op'amp'.

2.5 RELAY AND DRIVER

A Relay is an electromagnetic switch which is useful want to use a low voltage circuit to switch on and off a light bulb connected to the 220V mains supply. Driver is used to boost up the low voltage current in to the high voltage current.

3. RESULT AND DISCUSSION

The primary advantage of the automated nebulizer aid lie in its impact are provides the efficient method of inhalation system. This method provides the injection of proper drug according to the various levels of the breathing stages. By using spirometer, we can analyze the patient's lung capacity and with the help of the nebulizer, we can inject the drug according to the patient's condition by the automated system. As a result, by using the combined system of spirometer with nebulizer, this proposed system makes time-efficient, cost-effective and reducing the manual errors in the delivery of the drug system.

Spirometer acts as a vital tool for how much air is going to the lungs and how rapidly the air is inhaled and exhaled in the lungs (airflow). One of the benefits of Spirometry testing is that it can detect abnormalities in lung function even when no signs or symptoms of disease. Nebulizer provides the inhalation of the drug delivery to the patient and our proposed system gives the drug at proper levels at necessary time intervals according to the breathing condition.

4. CONCLUSION & FUTURE SCOPE

4.1 CONCLUSION

A System and a method were envisaged for proving the synchronization of the nebulizer and the spirometer for providing the drug to the patient. The purpose of the automatic nebulizer system is to achieve through its function the mode of operation in which the functioning of the breathing levels produced by the lung. The presence of the solenoid valve and the pneumatic cylinders came from the desire of developing a new type of mechanism that could be used in future

research projects regarding the nebulized therapy. The insertion of the new method of automatic nebulization method changed the design and the way of operating of the nebulizer in an automatic manner. From the base function through which the device was nebulizing automatically according to the patient's breathing levels, the modified compound device can operate in new mode that could make it sure suitable for different new applications

4.2 FUTURE SCOPE

In future, it will be used as a portable automated nebulizer aid and it will be able to exact drug level to the patient in an effective manner. It provide the drug at accurate for the level of the patient.

5. REFERENCES

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