

A Novel Approach to Nebulizer based Drug Delivery System

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-----ABSTRACT-----

The existing system of nebulizers are either for patients to clear spasm upto some extent and in some systems dosage limit is known. Normally most of the drug gets wasted during exhalation phase and the patients have to breath according to the medicine flow which might cause suffocation. For persons with chronic asthma attacks may not be able to breathe effectively, for this case flow of medicine must be regulated according to one's breathing pattern. This involves the monitoring of breathing rate. There are medicines like Albuterol, Intal solution, Ipratropium which would cause nasal bleeding, itching and nausea after the patient is nebulized. This is not an uncommon symptom in case of chronic asthma patients which requires a blood detector to stop the treatment immediately. And everything yet again needs to be reminded for care takers to provide immediate care for patient's well being. This would require monitoring of vital parameters like temperature and heart rate. The system will now be suitable for both hospitals as well as a homecare product.

Keywords-Nebulizers, Pocket sized nebulizers, conductivity sensor, asthma treating system.

1. INTRODUCTION

Nebulization system is the main device that is used to deliver medications to treat breathing diseases such as asthma, chronic obstructive pulmonary disease, bronchospasm and dyspnea. There are two types of nebulization systems like jet nebulizers and ultrasonic nebulizers. A most widely used one is jet nebulizers because of its effectiveness, affordability and maintenance in domiciliary use. Nebulization system is not a new health care. An overview of this progress is provided which begins by describing how the nebulizer controls flow of medicine based on the breathing characteristics of the patient. By the simultaneous development of the nebulizer system designs along with flow regulation techniques lead to effective treatment for breathing disorders.

The conductivity sensor which works based on the ions present the solution helps to identify the bleeding nose which is due to bursting of mucous layers. Most of the times bleeding nose is mild but not always. Certain times it extends for 15-20mins where then patient goes unconscious. Nebulizers are sustained for many years since, they are best known for treating

children. So, it is always important to check on their treatment levels and the emergency conditions. Bleeding nose is one of the emergency situation during nebulization. Conductivity sensor used in this system detects the bleeding nose and alerts the caretaker/nurse station. Hence the patient could be rescued on time.

M.D.Ivanova et.al [1] describes the enhancement of ultrasonic nebulizer that is being made for monitoring asthma attack frequency and dynamics of its treatment. C. S. Tsai et.al[2] proposed that The centimeter sized nozzles together with low power requirement enabled most recent realization of the first pocket-sized ultrasonic nebulizer (8.6 x 5.6 x 1.5 cm³) that contains nozzle A. Yardimci et.al[3] proposed that Correct matching of the nebulizer/compressor is seen to be important to ensure optimum performance. In order to make produced aerosols reach to target field adequately, it is notable that compressor power is important in jet nebulizers. Enrico M. Staderini et.al[4] proposed that Aerosol therapy nebulizer is a modern and efficient method of treating respiratory diseases. Nebulization treatment is in a process of development as new drugs intended for this method of care are requiring new ways of aerial administration. Carolin Unglert; et.al[5]

describes the development of an experimental setup that allows rapid determination of deposition characteristics of aerosols in different carrier gases and different geometries, based on particle size distribution measurements using the laser diffraction method. Ferry Pratama et.al[6] proposed In view of heart disease is a disease that should receive special attention, it is not excessive if the use of defibrillators plane must always be ready to be used properly and carefully so that they can be relied upon in dealing with emergencies from heart attack or other heart disorders. Li Xiangyang; et.al[7] proposes about MAX232 chip using AT89C51 Microcontroller to RS-232 Serial Communication.

2. METHODOLOGY

The nebulization system that we are presenting here consists of two motors to regulate medicine flow and oxygen flow. Oxygen is present in the system to convert aerosol solution into the mist form which is then inhaled by the patient. Both the motors depends on the patient's breathing pattern. This enables doctor to treat multiple disorder patients. Because some medicines used for treating chronic asthma attacks could vary these parameters in case of BP or Diabetic patients. The caretaker unit is necessary at homes as well as in hospitals. It helps to handle the patients well, especially in case of children

BLOCK DIAGRAM:

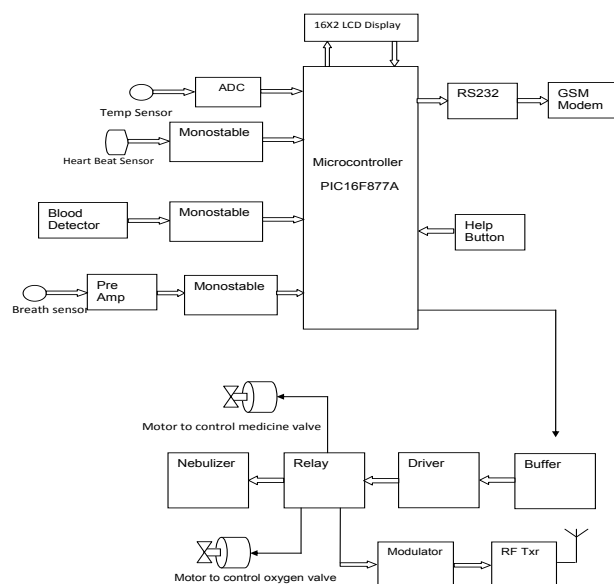


Fig 1: Block diagram of breathing control nebulization system.

This system requires some of the hardware components. Finger tip sensor is used for heart beat measurement. It has an LED that reflects through the blood flow at the tip of the finger. Temperature sensor – LM35 is used. For blood detection conductivity sensor is used. It conducts due to the ions present in blood. Hence, the bleeding nose is identified. It is incorporated in the mask close to the nose. To obtain respiration count MIC

with preamplifier is used. MIC detects the inhale and exhale phases and it is amplified to notice the rate. since, biomedical signals are low frequency signals pre-amplification is provided before it reaches mono-stable. Relay is a switch to drive the motors. Hence, breathing control nebulization is accomplished. Microcontrollers such as PIC 16F877A and Atmel AT89C51 is used to process the information and provide necessary actions. RF Transmitter and Receiver communicate between system and the caretaker unit. Buffer and Driver circuit for driving the motors for flow regulation. Mono-stable circuit gives one single output, used to estimate accurate results. Power supply circuit is the power house that supplies power. SIM 900 GSM Modem for communication. Buzzer alarm notifies the alert signals by the patient. Software required for interfacing are embedded C, keil micro vision.

Here we are designing and developing a system which will continuously monitor the breathing rate, heart beat, and body temperature of the patient and depending on the breathing rate flow of medicine is regulated. This will stop the delivery of medicine if there is any kind of changes in the parameters and also the system will send information to the care takers to alert them to provide immediate treatment in case of nose bleeding or any other patient's discomfortness due to nebulizer medicines.

The output of all the sensors will be given to the microcontroller. The microcontroller will process the signal. If there is any change in the patient's parameters then the controller will stop the nebulization and in case of breath rate medicine flow is regulated with the help of buffer, driver and a relay circuit.

The conductivity sensor will check for the nasal bleeding. The output of the sensor is given to the microcontroller via mono-stable. The microcontroller will process the signal and stop the nebulization to avoid the bleeding of nose and the wastage of expensive drugs.

Care Taker Unit:

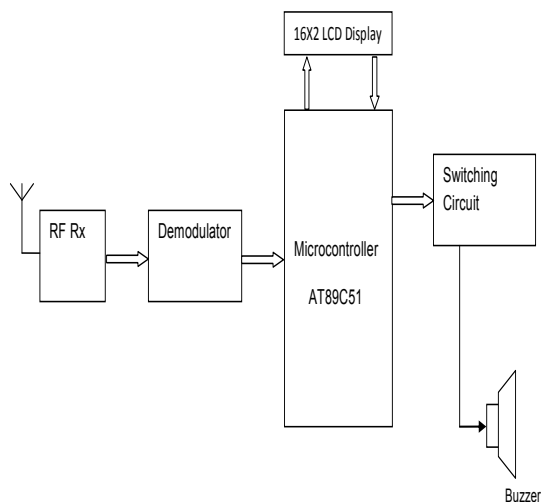


Fig2: Care taker unit for breathing control nebulization system.

In case of changes in the parameters microcontroller will send concern message to the care takers with the help of RF technique. The microcontroller will activate RF transmitter with the help of buffer, driver and relay to send message to the caretaker unit.

The RF transmitter at the care taker unit will receive the signal from the transmitter. The received signal will be given to the microcontroller. The message will be displayed on the LCD display and activate a buzzer to alert the caretakers.

3. RESULT

Nebulizer gives Efficient flow rate. It has no wastage of expensive drugs to the environment. Conditions like bleeding nose is detected. Better communication is setup between the patient and the caretaker unit. Time and duration of the therapy is unknown hence it may create a problem during medications.

4. DISCUSSION

The breathing control nebulization system presented here has completed with its 90% of the hardware implementation and has tend to perform well during testing. Software design is yet to be done.

There have been many development of nebulizers and an especially large number of them over the past several years. They all fail to treat the patients well. And lot of drug was getting wasted into the environment during their exhaling phase. Patients with heavy sputum were unable to inhale the medicines effectively. It has caused chest pain during nebulizations.

This nebulization system has designed to overcome all these effects. Medicine flow is regulated according to breathing rate of a person this enables no wastage of

drug during exhalation phase. When person has lower breathing rate speed of the nebulization is increased and in case higher breathing rate speed of nebulization is decreased. This way effective treatment is achieved without wastage of drug and as well as not causing much stress to the patient.

5. CONCLUSION AND FUTURE SCOPE

It is advantageous because it could detect the bleeding nose which is a common symptom during nebulization treatment. If the person is nebulized frequently or due to some of the medications such as Albuterol and Ipratropium solutions or it could be because of the bursting of mucous lining. When the bleeding nose is detected by the conductivity sensor nebulization system designed in such a way that it stops delivering the drug and sends an alert message to their respective caretakers / nurse stations in case of hospitals. Since, the nebulizers are best known home care products additional features to check the basic parameters during nebulization treatment could help in case of multiple disorder patients. Hence, monitoring of heart rate and temperature is provided.

Breathing sensor is used since the system is performed depending on its output.

In real time it can be made as a pocket held so that it is much easily portable. It should incorporate a recording system so that all medicine dosage and time would be recorded which could be easy for the doctors to guide the patients and change their medications. These can be done on further developing its technology.

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