



International Conference on Systems, Science, Control, Communication, Engineering and Technology 2016 [ICSSCCET 2016]

ISBN	978-81-929866-6-1
Website	icsscet.org
Received	25 – February – 2016
Article ID	ICSSCCET081

VOL	02
eMail	icsscet@asdf.res.in
Accepted	10 - March – 2016
eAID	ICSSCCET.2016.081

Development of Personal Lung Function Monitoring Device for Asthma Patients Using ARM Controller

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Abstract: Monitoring the lung function is the preferred course of action to give physicians and asthma patients a chance to control the disease jointly. It is easy for the supervision of patients to use. Spirometry which is a device is currently the best way to capture a complete picture of air flow and the lung function during inhalation and exhalation of the patients. Generally the machine requires an inspection and they are bulky. Portable peak flow meters are available but are inconvenient to use. Whereas no portable inexpensive biomarker devices are available to simultaneously measure the multiple chemical biomarkers. We have created user friendly and portable external mobile devices which is used to measure spirometry, exhaled nitric oxide, carbon monoxide, peak expiratory flow from asthma patients after two maneuvers. We have also designed a software to record and store the information and send a message to the physician. Telemetric capabilities help the physicians to make change in patient's medication sway by tracking asthma symptoms and lung function over time.

Keywords: Spirometry, peak expiratory flow (PEF), smart devices, breath analysis.

INTRODUCTION

Asthma is a chronic lung disease that narrows the airways. It causes continuous wheezing, chest tightness, shortness of breathe, and coughing. The coughing occurs at night (or) early in the morning. It affects all the age peoples but it starts mostly from the childhood. The airways are tubes that carry air into and out of your lungs. People who are affected by asthma have cremated airways [1]. The cremation makes the airways swollen and sensitive which makes the airways react strongly to certain inhaled substances [1]. When the airways react the muscles tighter which narrow the airways causing less air to flow into the lungs. The swelling become worsen making the airways even narrower [3]. From the period of 2008-2010, asthma prevalence was more among children than adults [3]. So we preferred a device to monitor the lung function and air flow for the asthma patients.

A spirometry device is a physiological test normally performed under the supervision of trained professionals. It measures the volume and flow rate of air that can be exhaled and inhaled, and it is useful in reporting the disease in the lungs [5]. Two of the most important parameters in the spirometry test are Forced Vital Capacitance (FVC), its made as forcefully and completely starting from full inspiration.

Peak expiratory flow (PEF) is an accurate, repeatable, and non-invasive test for monitoring air flow at home. Using sensors and mobile devices the portable technology focusing on full body physiological monitor becomes increasingly prevalent. It was developed by combining spirometry (FEV, spirometry graph), PEF, and bio maker. A software was developed to record the data. Software application enables the portable and inexpensive collection of lung function parameters.

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Cite this article as: B Saravana Manikandan, U S Dharshana, R Jaya Priya, N Karthikeyan, S Kirubha Shri. "Development of Personal Lung Function Monitoring Device for Asthma Patients Using ARM Controller". *International Conference on Systems, Science, Control, Communication, Engineering and Technology 2016*: 422-425. Print.

Literature Review

Reference 1

M. R. Miller, O. F. Pedersen, P. H. Quanjer has proposed that the response of the peak expiratory flow may be affected due to magnitude of PEF ,time taken to get PEF and the duration of peak is sustained. They assume the study to define the rise time and dwell time for flow above 90% and 95% of PEF. Blows were recorded using pneumotachograph from 912 patients.

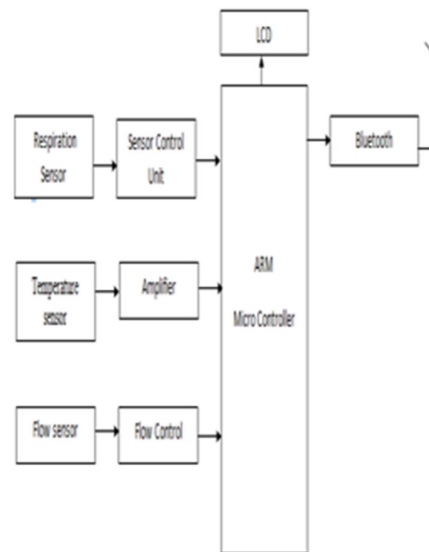
The largest PEF in blow was used to derive the PEF, FEV1, FVC, RT, DT90, and DT95. The values for RT, DT90 and DT95 were negatively skewed. Among 912 patients 277 had all their spirometric indices[5] .The patient air flow limitation has median RT which is smaller than normal patients and the same was found in DT90 and DT95.They conclude dwell time for PEF in men is shorter and the rise and dwell times in airflow limitation in patients are shorter.

Reference 2

J. Coti, A. Cartier, J. L. Malo, M. Rouleau, L. P. Bovnet has proposed that the complaints with peak expiratory flow monitoring in home management of asthma have their background that the consensus report on asthma management given that the use of peak flow meters is to access the degree of airflow obstruction. The best way to use the devices has not yet determine. Their objective is to assess the relevance with PEF measurements in the long term management of asthma and to identify the characteristics of patients with poor relevance. They were set 26 patients with moderate to severe asthma taking part in asthma education program. Their main outcome is to measure the PEF of the patients during morning and evening using a electronic peak flow meter with a 3 month memory. Their result is during the first month the relevance with PEF measurement were good. From the beginning 8 of 26 patients were never measured PEF. They conclude that most of the patients with moderate to severe asthma were not interest in measure PEF twice daily. But in the current management of asthma PEF measurement were personal interest in using then,where PEF improvement become an important outcome when doing clinically research.

Methodology

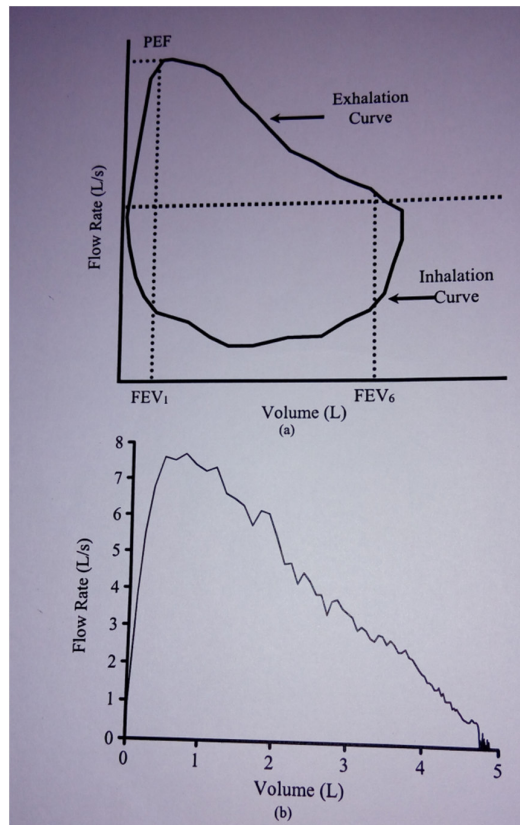
a. To Measure the Respiration Level



b. Block Diagram for Transferring Messages from Patient to Doctor



ARM is a widest range of microprocessor technology to address the performance, power, and cost for almost all application markets.



Analytical Report

S.NO	AUTHOR	TITLE	Measurement in patients	Merits in current scenario
1.	Nur Ilham Imarah binti Mou Yusop	Design of asthmatic severity monitoring control	To detect Ardour of astma by desining GUI	To measure the Ardour of asthma, respiration rate, peak flow monitoring, air flow of the patients by using a single component
2.	Souvik Das	Development of respiration rate meter-A low-cost design approach	To measure the respiration rate	
3.	P.V.Burkhart, M.K.Rayen, W.R.Revelette and A.Ohlmann	Improved health outcomes with peak flow monitoring for children with astma	To measure the peak flow monitoring	
4.	M.J.Morris and D.J.Lane	Tidal expiratory flow patterns in air flow obstruction	To measure the air flow in human body	

Conclusion and Future Work

Initial validation has proved that the devices used to measure are compared to the spirometer and satisfy the requirements of spirometry. It provides more opportunities to perform asthma patients remotely make patients more aware of their lung.

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We designed a software to measure the recordings personally and send a message (or)e-mail to the required physician.Sensors are used to detect the function of respiration,temperature of the body,and the flow of an airway.

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