

Pulmonary Function Test

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Abstract : Spirometry refers to a series of easy tests of a person's metastasis capacities. Spirometry takes measurements of the number of air inhaled and exhaled by the lungs throughout an exact amount of your time to determinate the pneumonic capability. The device used with this purpose is termed a measuring device. These measurements area unit helpful once it involves checking pneumonic operate, since results area unit valuable in diagnosis diseases like pneumonic pathology, asthma, monogenic disease and COPD (chronic impeding pneumonic disease). Vital signs area unit measurements of the body's most elementary functions. The four main very important signs habitually monitored by medical professionals and health care suppliers embrace the subsequent temperature, pulse rate, respiration rate (rate of breathing), force per unit area (Blood pressure isn't thought-about an important sign, however is usually measured in conjunction with the very important signs.) The respiration rate is measured with the assistance of a detector that monitor the slightest modification in pressure throughout inhale & exhale. Close air quality observance is applied therefore on generate information that meets the objectives of observance. Close air quality observance programme area unit required to see the prevailing quality of air, analysis of the effectiveness of management programme and to develop new programme. The report aims towards developing an additional uniform air observance network in order that information from numerous stations is comparable. The report discusses the assorted aspects of air quality observance network like that pollutants ought to be monitored, location wherever observance ought to be applied and also the numerous techniques of observance.

IndexTerms - Pneumonic, Pneumography, Pollutants, respiratory, Spirometry.

I. INTRODUCTION

Pulmonary operate tests give overall assessment of respiratory organ operate. They're accustomed valuate and monitor diseases that have an effect on system. Crapo (1994) mentioned the rules for interpretation of respiratory organ operate tests. Settler (1846) delineated the chance of measurement the respiratory organ diagnostic test by spirometry. Since then spirometry became a very important tool in clinical investigations. Analysis on spirometric measure continues to be the most focus within the metabolism analysis.

Arora and Raghu (1996) have explained the clinical significance of the flow-volume curve obtained from spirometric measurements. The various phases concerned in flow-volume curve were analysed additionally the interpretation of the improvement defects from the flow-volume curve was also mentioned. The authors have finished that flow-volume curve is that the Most worthy tool for the analysis of respiratory organ operate in human.

Sr. No.	Person age	sex	FEV ₁ (L/s)	IC (L/s)	TV (L/s)	FVC(L/s)	FEV ₁ /FVC
1	19	Male	2.69	1.89	0.681	2.82	0.95
2	19	Male	2.98	0.78	0.783	3.12	0.95
3	19	Male	3.56	2.89	0.904	3.61	0.98
4	23	Female	1.95	2.24	0.710	1.97	0.98
5	25	Female	1.53	1.76	0.497	1.62	0.94
6	25	Male	3.04	3.06	0.890	3.69	0.82
7	26	Female	1.25	1.36	0.647	1.27	0.98
8	26	Female	1.78	1.45	0.542	1.81	0.98
9	26	Male	2.23	2.52	0.507	2.58	0.86
10	30	Male	3.24	1.97	0.652	3.62	0.89
11	41	Female	1.00	0.97	0.370	1.27	0.78
12	47	Male	2.53	2.12	0.592	3.32	0.76
13	61	Female	1.18	1.34	0.343	1.24	0.95
14	62	Female	1.59	1.98	0.361	1.81	0.87
15	70	Female	1.27	1.54	0.566	1.58	0.80

Figure 1. Lung Profile

Howard et al (2001) have evaluated the spirometric measure in pre-school kids and statistically mentioned the foremost important parameters. Consistent with the authors, the foremost important parameters square measure FVC, FEV1, Peak breath Flow (PEF) and compelled breath flow at 25-75 you look after FVC (FEF25-75%). The authors have conjointly enclosed the demographic parameters like height, weight, age, sex and race of the topics below study. Primary care spirometry could be a unambiguously valuable tool within the analysis of patients with metabolism symptoms, permitting the overall professional person to diagnose or exclude COPD, typically to verify bronchial asthma, to work out the effectivity of bronchial asthma treatment and to properly stage patients with COPD and this has been shown by Derom et al (2008). The authors have finished that FEV1 is that the important parameter for distinctive the first obstruction during a subject and conjointly the effective use of spirometric measure is

to forestall the respiratory organ sickness.

1. Classification of spirometry

There are unit 2 basic categories of spirometers: laboratory units, that area unit either desktop consoles or cabinet-size machines operated by trained technicians; and transportable spirometers, that area unit either compact desktop units or hand-held devices meant for general-practice and residential use.

Spirometer measures the flow and volume of gas (air) occupation and out of the lungs throughout respiratory (Downing, 1995). The measured flow and volume values area unit premeditated as graphs known as the spirogram that area unit used for designation of the patient. Several strategies area unit won't to realise spirometers (Fishman, 1998; Weber, 1999). The spirometers area unit supported the measuring of either the rate of flow or the quantity of gas indrawn and exhaled throughout respiration. The pressure measuring system portrayed within the following figure, in fact, conjointly a rate of flow measurement-based technique wherever the rate of flow is indirectly determined by mensuration the pressure (e.g. measuring instrument meters).

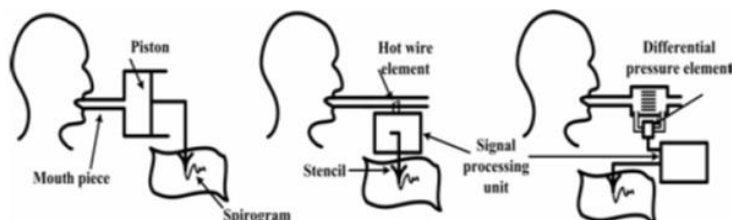


Figure 2. Types of measurement

2. Flow-volume loop

When a spirometry check is performed, the results area unit shown in a very graph referred to as a flow-volume loop or recording. This graph represents the air volume in liters on the coordinate axis and therefore the rate in liters per second on the coordinate axis. Inspiration results area unit planned below the horizontal axis whereas expiration information area unit planned on top of the horizontal axis. The flow-volume loop may be wont to pre-diagnose airway obstruction diseases by analyzing the form and magnitudes of the graph. Associate degree example of a recording may be seen within the following figure.

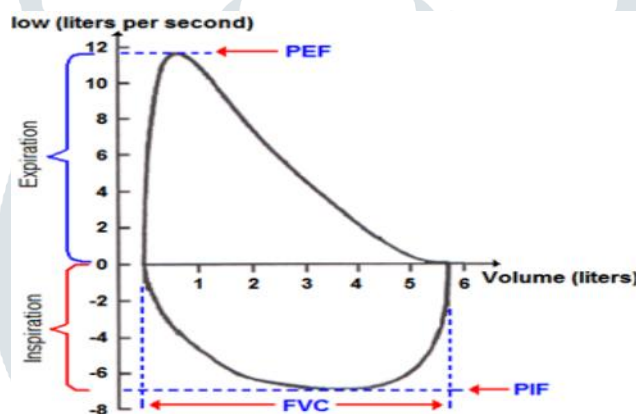


Figure 3. Flow-volume loop

The flow-volume curve depicts the relation between the lung volume and the maximum rate of airflow as lung volume changes during a forced expiration

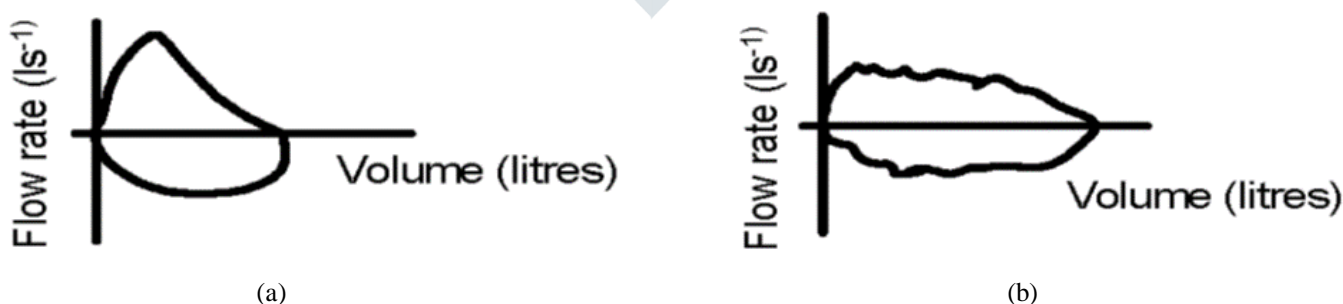


Figure 4. The flow-volume spirogram corresponding to different levels of disabilities:
(a) Normal or a healthy person (b) Fixed airway obstruction;



Figure 5. The flow-volume spirometry corresponding to different levels of disabilities:
(a) Extra thoracic obstruction and (d) Airflow obstruction

3. Respiration Rate

Many types of vital sign monitors are used for the measure of the Respiration Rate. Respiration Rate monitor exploitation unbearable detector and Respiration Rate monitor exploitation facial trailing technique is that the non-contact respiration rate watching system. Respiration Rate measure supported resistance Pneumography and Respiration Rate measure supported the pectoral enlargement embody the detector that square measure placed on the thorax. Respiration Rate monitor with MEMS primarily based electrical phenomenon Pressure detector, Respiration Rate monitor with temperature detector, Respiration Rate meter—a low-cost style approach uses sensors that square measure mounted inside the breathing machine. Development of a respiration rate meter, a inexpensive style approach uses a displacement electrical device with infrared (IR) - transmitter and IR-receiver for sensing the Respiration Rate, Respiration Rate Monitor supported resistance Pneumography measures changes within the electrical resistance of the person's thorax caused by metastasis or respiration [8]. Metastasis watching System supported the pectoral enlargement measure uses metastasis detector belt that created from plastic tube instrumentality, Axis, spring, Bumper edge, reflective objective detector. Temperature detector primarily based Breath Rate Monitor may be a time period system that computes the vital sign of the patient.

4. Air Quality Testing

The close air quality observance network involves measuring of range variety of air pollutants at number of locations within the country therefore on meet objectives of the observance. Any air quality observance network so involves choice of pollutants, choice of locations, frequency, length of sampling, sampling techniques, infrastructural facilities, man power and operation and maintenance prices. The network style additionally depends upon the kind of pollutants within the atmosphere through varied common sources, known as common urban air pollutants, like Suspended material (SPM), Repairable Suspended material (RSPM), Sulphur dioxide(SO₂), Oxides of N (NO_x), and CO (CO) etc. . The square measures to be chosen primarily are such areas that represent high traffic density, industrial growth, human population and its distribution, emission supply, public complaints if any and therefore the land use pattern etc. Generally, most of the time the idea of a network style square measure the pollution supply and therefore the waste product gift.

II. PROPOSED SYSTEM SPECIFICATION

1. Technical Specification

- **DHT11**
 - Supply voltage – 5V
 - Supply current – 0.5mA to 2.5mA
 - Measurement range – 20-90%RH °C
 - Humidity accuracy - ±5%RH
 - Temperature accuracy - ±2°C
 - Resolution - 1
 - Package – 4 Pin Single Row
- **MQ135**
 - Circuit voltage – 5V±0.1
 - Heating voltage - 5V±0.1
 - Temperature humidity - 20°C±2°C; 65% ±5%RH
 - Preheat time – Over 48 hours
- **MPXV7007**
 - Pressure range - -7 to 7kPa
 - Supply voltage – 5.0V
 - Supply current – 7mA
 - Accuracy - ±5%
 - Response time – 1ms

- **Microcontroller ATMEGA328P**
 - Operating voltage – 1.8 to 5.5V
 - 8bit microcontroller
 - FLASH with ISP
 - 32×8 general purpose instructions
 - 23 I/O programmable lines
 - 8 channel 10bit ADC
 - ADC resolution – 10bit
 - ADC conversion time – 13 to 260µs
- **USB**
 - Signal - 5V DC
 - Maximum current – 0.9A
 - Protocol – serial
 - Bitrate – 1.5,12,480,5000,10000 Mbit/s
 - Maximum devices – 127

III. FLOWCHART OF REAL TIME SIGNAL ACQUISITION

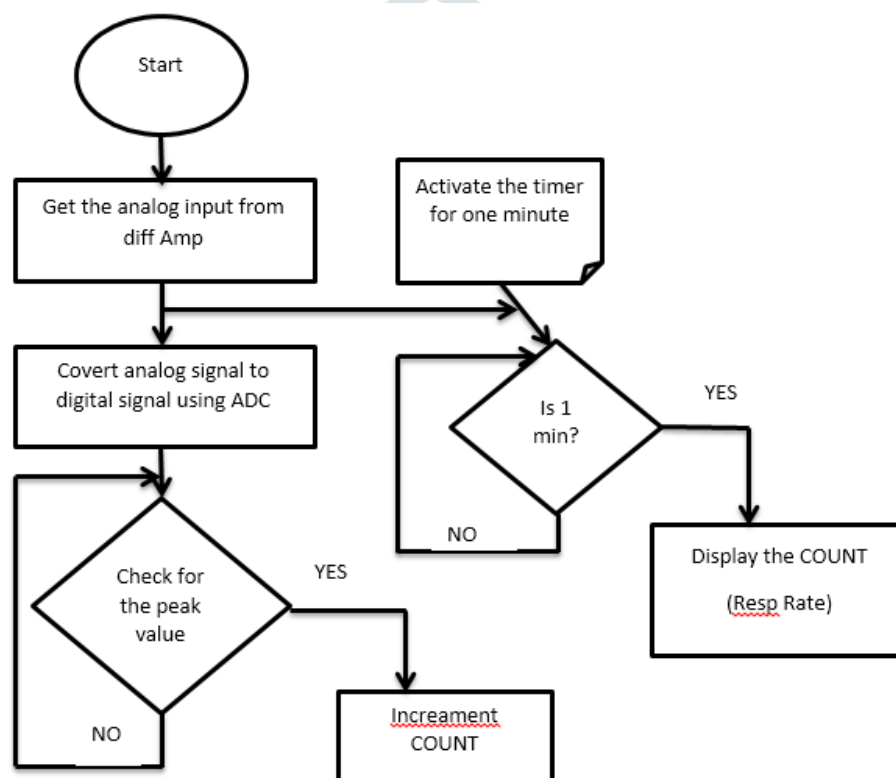


Figure 6. Flowchart of Respiration Rate Measurement

CONCLUSION

An examination of ventilation perform of lungs is important for analysis of purposeful properties of human system. It used either for estimation of defects in system or thought of fitness load in sport drugs. It'll aid domestic first-level diagnostic assay for pulmonic diseases like bronchial asthma, emphysema, and monogenic disorder.

Various sensing elements for flow measurements are studied and also the differential pressure sensor has been utilized in the measuring system model, thus on scale back the dimensions and price of the instrument. The totally differential pressure kind pressure sensing element works on different principle than different 2 sensors. It measures pressure distinction between 2 ports and offers voltage out love pressure distinction. One biggest advantage is that it's internally tag has temperature compensation over 0°C to 85°C. The spirometric information ought to be analyzed and also the parameters like FEV1 should be computed as suggested by ATS. Environmental air quality affects the respiration rate, volume of air inhaled and expelled out. The amount of the gases like carbon oxides, Sulphur mixtures etc. are present in environment which are harmful to the human beings. According to percentage sensed it is easy for us to take required precaution.

FUTURE SCOPE

- As a web server is embedded into it, the patient and the doctor (who may be located far apart) can interact with each other in many ways. On the specialist's request, the patient can take the test online.
- Detection of lung disorders based on the parameters measured from the graph showing FVC, FEV1, VC etc. These disorders can be declared by using Standards specified by World Health Organization.
- Can make use of smart card to store the output of spirogram for reference of past medications.

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