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# Lung Disease Discernment Using Exhaled Gas of Patient

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ABSTRACT

*In the present world many number of people are being affected by lung cancer. Cancer is one of the deadly diseases that cannot be identified in the early stage. Especially lung cancers are highly dangerous to people .It leads to increase in death rate due to lung cancer because the patients affected by lung cancer are not able to identify it earlier. The pulmonary function of the affected patient is checked by using certain method like spirometer test, CPET and body plethysmography are done to evaluate the lung functionality of the patient. In this paper we are developing a model for identifying the lung cancer earlier by the patient itself so that people can be saved and we can prevent cancer. Four sensors used here are respiration, PH, MEMS and gas sensor. We use a respiration sensor to measure the exhaled volume of the patient which is below 10ppm and is normal for people with 30ppm and above. By using the gas sensor and MEMS sensor we are able to measure the amount of OH released by the patient. MEMS sensor will identify the shivering of a lung cancer patient. The PH value of a cancer patient is less than 7 so PH sensor is used to measure the cancer cells PH which is acidic.*

Keywords: MEMS sensor, Cancer and PH value.

## 1. INTRODUCTION

Each year more people die of lung cancer than of colon, breast, and prostate cancers combined. Lung cancer mainly occurs in older people. [1] About 2 out of 3 people are diagnosed with lung cancer are 65 or older, while less than 2% are younger than 45[2]. The average age at the time of diagnosis is about 70.The American cancer society estimates for lung cancer in the United States for 2017 are about 222,500 new cases of lung cancer and about 155870 deaths from lung cancer. [3]

There is no way of preventing cancer. It can only be diagnosed and the life span of the patient can be increased by treatment. But the major drawback is that cancer cannot be detected in the early stage it can only be identified in the final stage. [5] The cause of cancer is due to the carcinogens that are released from the cigarette smoke and from the tobacco usage of the people. Some of the cancer can be easy to catch in the early stage, they have some signs and symptoms that can be noticed, but that is not always the case.

## 2. EXISTING SYSTEM

In the existing systems lung cancer is detected by a tedious process. The detection of cancer is done only at the final stage of cancer. The patient suffers from the symptoms of cancer only at stage 3 and 4. When the patient realizes these symptoms the patient will undergo the tests such as Spirometers test, Body plethysmography, CPET, Inhalation challenge test, and gas diffusion test.[2]

In the existing methods such as CPET (Cardio Pulmonary Exercise Test) is a non-invasive method used to access the performance of the heart and lungs at rest and during exercise. During CPET test the patient will be required to perform mild exercise on an upright bicycle whilst breathing into a mouth piece. The patients suffer from discomfort and also aged people find it difficult to perform the exercises.
Spirometer test is used to only when the patient is severe at the final stage of COPD Body Plethesmography is used to measure the FRC (Functional Residual Capacity) of the lung. It is a complex process to measure the whole body air and it costs 30000 to 40000$. The methods used to diagnose lung diseases are done at the final stage of the patient which leads to more number of deaths [18].

### *A. Drawbacks of Existing System*

1. All the processes mentioned above are done only at the last stage of cancer
2. Body plethesmography test cost 30000 to 40000 dollars which is not affordable by rural people
3. The CPET test cause discomfort to patient while doing the exercises
4. By doing these test and diagnosing cancer the patient can undergo further treatments but cannot live long life

## 3. PROPOSED SYSTEM

People affected from Lung cancer cannot be cured but treatment can help them to live for many years.

Volume 1, Issue 6, Pages 48-52, July 2017

Lakhs of people die from lung cancer every year. To diagnose the lung cancer in the early stage we propose a system which is easy to diagnose lung cancer by the individual person itself at home. In the proposed system we use 3 sensors such as Gas sensor, Flow sensor and MEMS sensor

- In this system we check the lung functionality by measuring the inhaled and exhaled lung volume of the patien**t**
- The lung cancer can be detected by the presence of hydroxyl groups in the exhaled gas
- The respiration level of a normal patient will be above 30 ppm. But a patient with lung cancer suffers from shortness of breath and hence it is below 10ppm.

In this method we use the respiration sensor to measure the exhaled volume of the patient. Normally C02 is released out by a normal human being by intake of oxygen. In the exhaled gas co2 content is higher. When a person is starting to develop lung cancer the exhaled gas contains more of hydroxide and carbon groups. The Oh measurement in the exhaled gas determines the stage of cancer. When the breath range of the person goes below 10 it is abnormal.. The MEMS sensor is used to measure the shivering range of the person. If the shivering value is higher than 360 it is abnormal shivering for a person. We measure 3 important values for the detection process such as

- MEMS value
- Respiration value
- Gas sensor value (Presence of OH content)
- PH value

The PH value is one of the most important factor to be measured. The cancer cells are acidic in nature, the cancer cells are formed and they grow in an acidic environment. The PH value of the cancer affected patient will be less than 7. The normal PH of the patient is basic tat is 7.4-7.6. By measuring all these values we can detect whether the patient is affected by cancer or not.

## 4. WORKING MODEL

### *A. Flow Sensor*

Flow meters are devices that measure the amount of liquid, gas or vapor that passes through them. Some flow meters measure flow as the amount of fluid passing through the flow meter during a time period (such as 100 lts per minute). Other flow meters measure the totalized amount of fluid that has passed through the flow meter (such as 100 lts).

Flow meter consists of a primary device, transducer and transmitter. The transducer senses the fluid that passes through the primary device. The transmitter produces a usable flow signal from the raw transducer signal. These components are often combined, so the actual flow meter may be one or more physical devices. Flow measurement can be described by

$Q = A \cdot v$, which means that the volume of fluid passing through a flow meter is equal to the cross-sectional area of the pipe (A) times the average velocity of the fluid (v); and $W = r \cdot Q$, which means that the mass flow of fluid passing through a flow meter (A) is equal to the fluid density (r) times the volume of the fluid (Q). Volumetric flow meters directly measure the volume of fluid (Q) passing through the flow meter. The only flow meter technology that measures volume directly is the positive displacement flow meter. Velocity flow meters utilize techniques that measure the velocity (v) of the flowing stream to determine the volumetric flow. Examples of flow meter technologies that measure velocity include magnetic, turbine, ultrasonic, and vortex shedding and fluidic flow meters. Mass flow meters utilize techniques that measure the mass flow (W) of the flowing stream. Examples of flow meter technologies that measure mass flow include Carioles mass and thermal flow meters. Inferential flow meters do not measure volume, velocity or mass, but rather measure flow by inferring its value from other measured parameters. Examples of flow meter technologies that measure inferentially include differential pressure, target and variable area flow meters. Flow computers are often used to compensate flow measurements for actual process conditions, such as pressure, temperature, viscosity, and composition. Additional flow meter technologies include flow meters that measure liquid

Volume 1, Issue 6, Pages 48-52, July 2017

flowing in an open channel, and insertion flow meters that measure flow at one location in a pipe and use this measurement to infer the flow in the entire pipe. Insertion flow measurement systems often use a flow computer to compensate for hydraulic effects.

***B.MEMS Sensor***

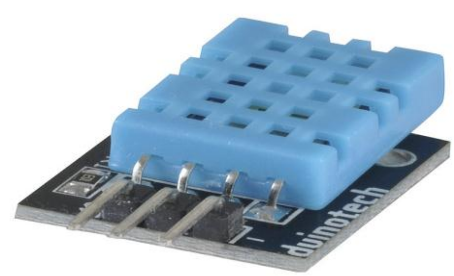
Micro-electro-mechanical systems (MEMS, also written as micro-electro-mechanical, Micro-Electro-Mechanical or microelectronic and micro-electro-mechanical systems and the related micro-mechatronics) is the technology of microscopic devices, particularly those with moving parts. It merges at the nano-scale into systems (NEMS) and nanotechnology. MEMS are also referred to as micro machines in Japan, or micro systems technology (MST) in Europe. MEMS are made up of components between 1 and 100 micrometres in size (i.e. 0.001 to 0.1 mm), and MEMS devices generally range in size from 20 micrometres to a millimeter (i.e. 0.02 to 1.0 mm), although components arranged in arrays (e.g., Digital micro mirror devices) can be more than 1000mm2. They usually consist of a central unit that processes data (the microprocessor) and several components that interact with the surroundings such as micro sensors because of the large surface area to volume ratio of MEMS, forces produced by ambient electromagnetism (e.g., electrostatic charges and magnetic moments), and fluid dynamics (e.g., surface tension and viscosity) are more important design considerations than with larger scale mechanical devices.

MEMS technology is distinguished from molecular nanotechnology or molecular electronics in that the latter must also consider surface chemistry. The patients who are affected by lung cancer are mostly aged people so they suffer from shivering when they are affected by cancer so MEMS sensor measure the shivering value of the patient when it is above the threshold value.

***C. PH Sensor (Humidity Sensor)***

Cells maintain intracellular pH within a narrow range (7.1–7.2) by controlling membrane proton pumps and transporters whose activity is set by intra-cytoplasmic pH sensors. These sensors have the ability to recognize and induce cellular responses to maintain the pH, often at the expense of acidifying the extracellular pH. In turn, extracellular acidification impacts cells via specific acid-sensing ion channels (ASICs) and proton-sensing G-protein coupled receptors (GPCRs). The complex mechanisms by which they transduce acid pH signals to the cytoplasm and nucleus are not well understood. However, there is evidence that expression of proton-sensing GPCRs such as GPR4, TDAG8, and OGR1 can regulate aspects of tumor genesis and invasion, including cofilin and talin regulated actin (de-polymerization). Major mechanisms for maintenance of pH homeostasis include mono carboxylate, bicarbonate, and proton transporters. Notably, there is little evidence suggesting a link between their activities and those of the extracellular H+-sensors, suggesting a mechanistic disconnect between intra- and extracellular pH. Understanding the mechanisms of pH sensing and regulation may lead to novel and informed therapeutic strategies that can target acidosis, a common physical hallmark of solid tumors.

***D. Gas Sensor***



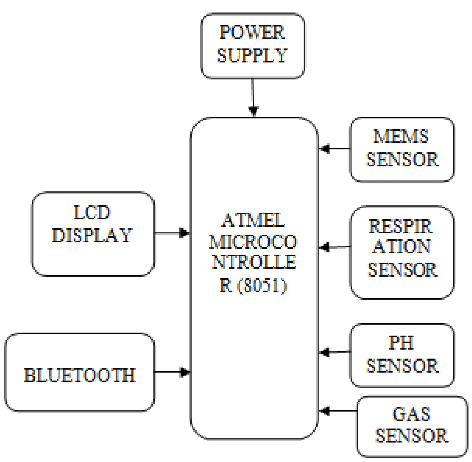

Gas sensors are available in wide specifications depending on the sensitivity levels, type of gas to be sensed, physical dimensions and numerous other factors. This Insight covers a methane gas sensor that can sense gases such as ammonia which might get produced from methane. When a gas interacts with this sensor, it is first ionized into its constituents and is then adsorbed by the sensing element. This adsorption creates a potential difference on the element which is conveyed to the processor unit through output pins in form of current. The gas sensor module consists of a steel exoskeleton under

Volume 1, Issue 6, Pages 48-52, July 2017

which a sensing element is housed. This sensing element is subjected to current through connecting leads. This current is known as heating current through it, the gases coming close to the sensing element get ionized and are absorbed by the sensing element. This changes the resistance of the sensing element which alters the value of the current going out of it. The patient who is affected by cancer will release OH content in a higher amount than the normal person. [3]

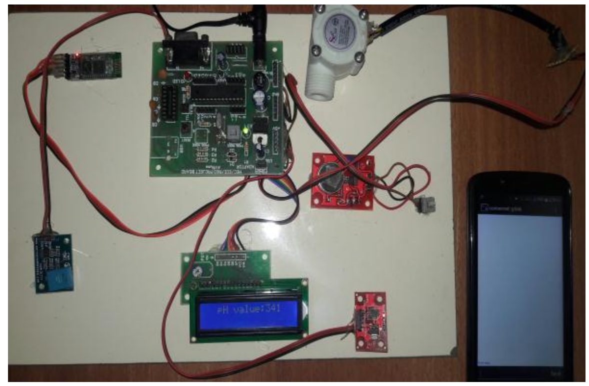
## V. BLOCK DIAGRAM

The block diagram of the system is given below which consists of ATMEL microcontroller (8051).




## VI. RESULTS AND DISCUSSION

In this model we have designed a device to detect the lung cancer in a patient in a prior manner before the patient could reach the final stage of cancer. By doing so we are able to save number of people. This overcomes the problem of undergoing many tests to diagnose cancer. It is easy and simple way of testing our lung function on a daily basis regularly by the patient itself. The patient who uses the device gets a message via the Bluetooth about their lung functionality as normal and abnormal. If he/she is a healthy person they will get a message as normal or if any of the symptoms shows that they have been affected by cancer then they will get a message as abnormal and the exact stage of cancer is detected and displayed to them.



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Volume 1, Issue 6, Pages 48-52, July 2017

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