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## Detection technique to identify Asthma level in children

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### ABSTRACT

*To obediently and modestly observes the asthma patient's atmosphere to classify the presence of two asthma-exacerbating activities, smoking and cooking using the Foobot sensor. Asthma management is challenging as it involves understanding causes and avoiding triggers that are both multi-factorial and distinctive to every individual. Moreover, it is tricky for doctors to constantly monitor the health of lots of patients and the environmental triggers simultaneously; or to get sufficient data on the environment in which the patient lives. A data-driven approach to develop a continuous monitoring-activity detection system aimed at understanding and improving indoor air quality in asthma management. In this learning, we were productively talented to notice a high absorption of Particulate Matter (PM), Volatile Organic Compounds (VOC), and Carbon Dioxide (CO<sub>2</sub>) during cooking and smoking activities. We detected (a) smoking with an error rate of 1%, (b) cooking with an error rate of 11%, and (c) obtain an overall 95.7% percent accuracy classification across all events (control, cooking and smoking). A scheme will permit doctors and clinicians to associate potential asthma symptoms and exacerbation information from patients with environmental factors without having to personally be present.*

**Keywords:** Asthma Management, Cooking, Indoor Air Quality Sensor, and Smoking.

### 1. INTRODUCTION

Asthma is a chronic, lifelong condition that cannot be cured. However, it can be successfully controlled and managed with proper care and medication. Since the mid-70's the incidence of asthma and asthma-related deaths has been on the rise, though an exact cause is not known. A key part of managing asthma and maintaining control is the avoidance of substances which trigger asthma symptoms. However, this is nearly impossible in the case of airborne triggers which are ubiquitous in the environment such as pollen or traffic-related air pollution. It is well understood that the quality of outdoor air can severely impact people with asthma. However, we spend the majority of our time indoors and as such the quality of our indoor air can have an even bigger impact on our health, especially for people with asthma and other chronic respiratory conditions

Housing was identified as a key area contributing to health and wellbeing in the Irish Government's 'Healthy Ireland Framework'. Many indoor problems which affect asthma such as serious mould, inadequate ventilation, and carpeted flooring are expensive to improve. Due to the cost of remedying these issues, many low-income families are living in environments that pose serious risks to their health. These health effects and the importance of good indoor air quality are starting to be recognized internationally. As such it is essential to understand the impact and status of indoor air quality in the Irish context.

This study aimed to assess the air quality in the homes of 9 members of the Asthma Society and monitor their asthma symptoms over a 3 month period. For the first 4-6 weeks of the study, the air quality in their homes was monitored using a Nuwave Cair sensor, while participants logged any asthma symptoms they experienced. After this, a Cliniair unit from Environ was installed in each of the homes for the remaining 6 weeks. Air quality and any asthma symptoms continued to be logged while the air filtration unit was in the home. The incidence of asthma symptoms before and after the installation of the Cliniair unit was analyzed to determine whether air filtration in the home allowed for better asthma control and fewer symptoms. It was found that the use of the Cliniair unit caused a significant reduction in airborne particles present in the home. Further, a high level of particulates in the air appeared to be linked to the occurrence of symptoms

## **2. RELATED WORKS**

In [1] J. L. Nguyen, J. Schwartz, D. W. Dockery et al presents many studies report an association between outdoor ambient weather and health. Outdoor conditions may be a poor indicator of personal exposure because people spend most of their time indoors. Few studies have examined how indoor conditions relate to outdoor ambient weather. Regular indoor hotness, observable hotness, relative humidity (RH), and complete humidity (AH) determined in 16 homes in superior Boston, Massachusetts, from May 2011 to April 2012 was compared to measurements taken at Boston Logan airport. The relationship between indoor and outdoor temperatures is nonlinear Outdoor RH is a poor indicator of indoor RH, while indoor AH has a strong correlation with outdoor AH year-round. However, if indoor conditions correlate strongly with ambient outdoor conditions, using weather service observations of outdoor conditions would be a sufficient, practical indicator of personal exposure.

In [2] Rubén Daniel Ledesma, Pedro Valero-Mora, and Guillermo Macbeth et al present Exploratory Factor Analysis and Principal Component Analysis are two data analysis methods that are commonly used in psychological research. When applying these techniques, it is important to determine how many factors to retain. This decision is sometimes based on a visual inspection of the Scree plot. However, the Scree plot may at times be ambiguous and open to interpretation. These credentials mean to determine an integer of graphical and computational improvement to the Scree plot in order to make it more valid and informative. These enhancements are based on dynamic and interactive data visualization tools, and range from adding Parallel Analysis results to "linking" the Scree plot with other graphics, such as factor-loadings plots. To demonstrate our planned improvement, we initiate and portray an example based on real data on which a principal component analysis is appropriate. We hope to provide better graphical tools to help researchers determine the number of factors to retain. Exploratory Factor Analysis and Principal Component Analysis are two data analysis methods that are commonly used in psychological research

In [3] Meredith C. McCormack, Patrick N. Breysse, Nadia N. Hansel et al present Asthma extremely affects inner-city, option family in the U.S. outside contaminant concentration, counting particulate matter (PM), are higher in inner-cities and contribute to childhood asthma morbidity. Although children spend the majority of time indoors, indoor PM exposures have been less extensively characterized. There is a community health very significant to typify indoor sources of PM within this susceptible inhabitant to enable effective intervention strategies. In the present study, we required recognizing determinants of indoor PM in homes of Baltimore inner-city pre-school children. Children ages 2–6 (n ¼ 300) who were predominantly African-American (90%) and from lower socioeconomic backgrounds were enrolled. Integrated PM<sub>2.5</sub> and PM<sub>10</sub> air sampling were conducted over a 3-day period in the children's bedrooms and at a central monitoring site while caregivers completed daily activity diaries. Homes of the pre-school family in inner-city Baltimore had indoor PM concentrations that were double as soaring as immediate outside concentrations

In [4] J.E. Rizzuto, P.E et al present The New York State Energy Research and Development Authority in cooperation with New York State and national utility research organizations and the United States Environmental Protection Agency has recently completed a three-part study of infiltration and indoor air quality in New York State homes. This paper presents the summary results of that program together with the objectives, research design and experimental protocols which guided its conduct. The purpose of the study was to examine indoor air quality in New York State homes and to assess the potential impact of conservation measures which reduce air infiltration in these homes. In the first task, the air infiltration reduction effects of common house tightening measures were determined. In the second task, annual average radon concentrations were determined for the basements and first-floor living areas of over 2,000 New York State homes. This was supplemented by heating season average radon concentrations for the first-floor living area.

In [5] Jeremy A. Sarnat, Petros Koutrakis, Helen H. Suh et al presents Indoor ventilation was an important determinant of personal PM<sub>2.5</sub> exposures and resulting personal-ambient associations. Associations between personal PM<sub>2.5</sub> exposures and corresponding ambient concentrations were strongest for well-ventilated indoor environments and decreased with ventilation. This decrease was attributed to the increasing influence of indoor PM<sub>2.5</sub> sources. Evidence for this was provided by SO<sub>4</sub><sup>2-</sup> measurements, which can be thought of as a tracer for ambient PM<sub>2.5</sub>. For SO<sub>4</sub><sup>2-</sup>, individual-ambient relations were stalwart silky in inadequately ventilate indoor environments, suggesting that personal exposures to PM<sub>2.5</sub> of ambient origin are strongly associated with corresponding ambient concentrations. Weak correlations between ambient PM concentrations and personal exposures reported in various cross-sectional exposure studies have been offered by some as evidence that ambient concentrations are poor surrogates of personal PM exposures and that findings reported in epidemiologic studies of PM are inaccurate.5 More recent observations examining the longitudinal associations between personal and ambient PM have muted some of this concern.

## **3. PROPOSED SYSTEM**

Our explore is the first step towards evaluate whether access to data related to patient's living surroundings can help doctors in permanent monitoring of the indoor air quality of their asthma patients and incorporate them with clinical records that contain information on an individual's asthma triggers, allergies, medications, and past emergency room visits for further insights on the role played by the indoor environment in asthma management. The aspire of this manuscript is two-fold: firstly, we there a corroboration study of Foobot for the measurement of the personal indoor environmental measure in the kHealth structure, and second we present our exploration of whether it is probable to productively detect cooking and smoking activities in the indoor environment

### **Indoor Air Quality**

The World Health Organization (WHO) attributes 24% of global disease burden and 23% of all deaths to environmental factors. Of these, 4.3 million deaths are attributed to indoor air pollution. It is undeniable that our homes have a substantial impact on our health.

However, not everyone is fully in control of their home environment. In Ireland, close to half a million homes are made up of rented accommodation and social housing. The hundreds of thousands of people living in these homes are reliant on private landlords, local authorities and voluntary housing associations to maintain the health and safety standards of their domestic environment. While some interventions may be relatively cheap and can be carried out easily, others such as replacing carpet with wood flooring or improving ventilation systems may be prohibitively expensive. Many people with low income may be living in environments which are doing long-term damage to their health. Cost aside, families renting or living in social housing are unlikely to be able to make changes to the permanent fixtures or structures of their homes without permission from a private landlord or local authority.

#### 4. PROPOSED BLOCK DIAGRAM

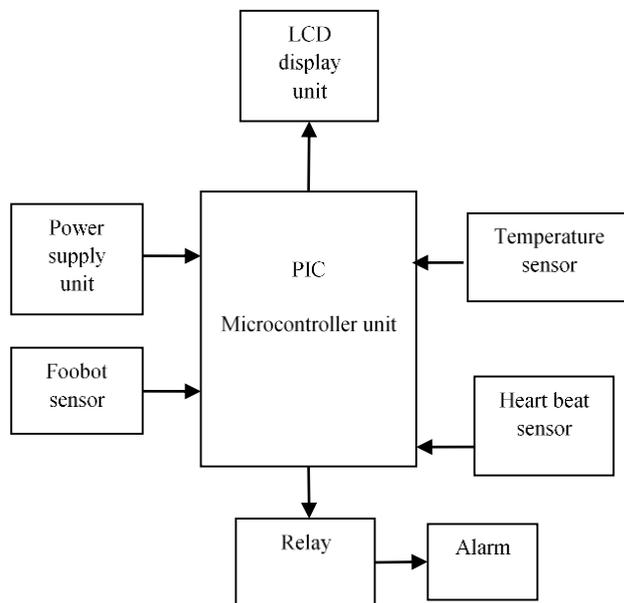


Fig 1 Block diagram

#### 5. PROPOSED BLOCK DIAGRAM EXPLANATION

##### a. PARTICULATE MATTER

Particulate matter is a key contributor to indoor air pollution. Particles originate from diverse sources, which can be natural or man-made. Natural sources include mould spores, pollen, pet dander and plant debris. Man-made sources are often linked to combustion processes include cigarette smoking, cooking emissions and wood, peat or coal burning in fireplaces. Of course, some particulate matter may originate from the outdoor environment. Particle size is also an important factor as the health effects can be different. For this reason, we categorize particles into three groupings. Coarse particles are the largest and about 5-10 of them can sit side by side in the width of a human air example. They can reach the central airways. Fine particles (about 20 can sit in a hair) reach the outer lungs where gas exchange takes place; they can also get into the blood stream to cause cardiac problems. Ultra fine particles (about 500 can sit in a hair) are able to reach the heart and brain barrier.

##### b. VOLATILE ORGANIC COMPOUNDS

Volatile organic compounds (VOCs) are carbon-containing chemicals, which evaporate rapidly and are considered harmful to human health or the environment when present in the air. Common VOCs include benzene and formaldehyde from furniture, polycyclic aromatic hydrocarbons (PAHs) from combustion, perfumes, aerosols, and fumes from cleaning sprays. Previous studies have shown an association between VOC exposure and asthma in young children. Many individual VOCs were found to increase the risk of asthma (and cancer) development, particularly in the case of benzene. Another study found that the presence of propylene glycol and glycol ethers in the air of children's bedrooms was linked to a 1.5 fold increase in the risk of asthma development. Formaldehyde is known to negatively impact people with asthma. In particular, symptoms such as a chronic cough, wheezing and poor lung function were found to be more prevalent among adults living in homes with high formaldehyde levels.

##### c. POWER SUPPLY UNIT

The ac voltage, normally 220V rms, is coupled to a transformer, which steps that ac voltage down to the level of the preferred dc output. A diode rectifier then provides a full-wave rectified voltage that is originally filtered by an easy capacitor filter to produce a dc voltage. This resulting dc voltage frequently has a few ripple or ac voltage variations. A regulator circuit removes the ripples and also remainders the similar dc worth even if the input dc voltage varies, or the load linked to the output dc voltage changes. This voltage regulation is typically obtained by one of the accepted voltage regulator IC units.

#### d. TRANSFORMER

The potential transformer will step down the power provide a voltage (0-230V) to (0-6V) level. Then the inferior of the potential transformer will be connected to the accuracy rectifier, which is constructed with the assist of op-amp. The compensation of using precision rectifier is it will give peak voltage output as DC; rest of the circuits will present only RMS output.

#### e. BRIDGE RECTIFIER

When four diodes are associated as exposed in the figure, the circuit is called as a bridge rectifier. The contribution to the circuit is practical to the diagonally differing corners of the network, and the output is taken from the residual two corners.

#### f. IC VOLTAGE REGULATORS

Voltage regulators encompass a collection of largely used ICs. Regulator IC units grasp the circuitry for orientation source, comparator amplifier, control machine, and overload protection all in a single IC. IC units give regulation of also a set positive voltage, a fixed negative voltage, or an adjustably set voltage. The regulators can be chosen for operation with load currents from hundreds of milli amperes to tens of amperes, equivalent to power ratings from milli watts to tens of watts.

#### g. PIC 16F877A

This influential thus far easy-to-program CMOS FLASH-based 8-bit microcontroller PIC16F877A packs Microchip's powerful PIC® architecture into a 40- or 44-pin package and is upwards well-suited with the PIC16C5X, PIC12CXXX, and PIC16C7X devices. The PIC16F877A conceal knowledge 256 bytes of EEPROM information reminiscence, personality programming, an ICD, 2 Comparators, 8 channels of 10-bit Analog-to-Digital converter, 2 capture/compare/PWM functions, the synchronous chronological port can be configured as also 3-wire Serial Peripheral boundary or the 2-wire Inter-Integrated Circuit truck and a Universal Asynchronous Receiver Transmitter. All of these features create the PIC16F877A perfect for extra greater height A/D applications in automotive, industrial, appliances and consumer applications. The 16F877A is one of the most accepted PIC microcontrollers and it's easy to see why - it come in a 40 pin DIP pin out and it has a lot of interior peripherals. The 40 pins create it easier to use the peripherals as the functions are spread out over the pins. This makes it easier to choose what outside devices to fasten lacking worrying too much if there sufficient pins to do the job.

#### h. FOOBOT SENSOR

Foobot is the foremost coupled device that helps you monitor and organize your indoor air quality with sleek design and powerful tech. Foobot is packed with sensors to notice the subsequent factors of indoor air pollution. Foobot uses a MOS (Metal Oxide Semiconductor) to notice total VOCs). This sensor does not distinguish every VOC (formaldehyde, toluene, benzene, etc.) but gives a worldwide representation of VOCs levels. This sensor is enormously responsive to CO levels.

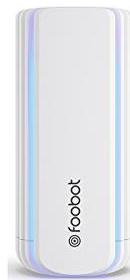


Fig 2 Foobot sensor

#### i. HEART RATE SENSOR



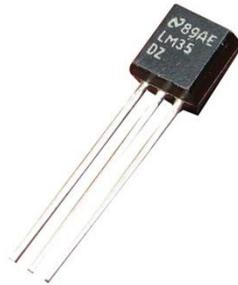
Fig 3 Heart rate sensor

A heart rate supervise is temperament check devices which permit one to analyze his heart rate in actual time or record the heart rate for later learning. It is largely used by performers of different types of physical exercise. Modern heart rate monitors routinely include two elements: a trunk strap transmitter and a wrist receiver or mobile phone (which typically doubles as a watch or phone). In early plastic straps, water or liquid was required to get good performance. Afterward, units have used a conductive elegant

material with built-in microprocessors which analyze the EKG signal to decide heart rate. Strapless heart rate monitors now allow the user to just stroke two sensors on a wristwatch show for a few seconds to view their heart rate. These are popular for their comfort and easiness of use though they don't give as much element as monitors which use a chest strap.

#### **j. TEMPERATURE SENSOR**

Temperature sensors are imperative to a collection of daily products. For illustration, family ovens, refrigerators, and thermostats all rely on temperature maintenance and control in order to function properly. Temperature control also has applications in substance engineering. Examples of this include maintaining the temperature of a substance reactor at the ideal set-point, monitoring the temperature of a possible runaway reaction to ensure the safety of employees, and maintaining the hotness of streams released to the environment to minimize a harmful environmental collision. While temperature is normally sensed by humans as “hot”, “neutral”, or “cold”, chemical engineering requires precise, quantitative measurements of temperature in order to precisely control a progression. This is achieving through the use of temperature sensors and temperature regulators which procedure the signals they receive from sensors.



**Fig 4 Temperature sensor**

#### **k. RELAY**

A relay is an electrically operated switch. Many relays utilize an electromagnet to function a switching apparatus automatically, but other operating principles are also used. Relays are used where it is required to manage a circuit by a low-power signal with absolute electrical isolation among control and controlled circuits or where numerous circuits must be controlled by one signal. The chief communicates be old in long aloofness cable circuits, replicate the signal impending in from one circuit and re-transmitting it to another. Relays were used lengthily in phone interactions and early computers to do logical operations.

### **6. BASIC DESIGN AND OPERATION**

An undemanding electromagnetic broadcast consists of a coil of cable enfold around a soft iron core, a flatten yoke which provides a low reluctance pathway for magnetic flux, a movable iron armature, and one or more sets of contacts. The framework is hinged to the yoke and mechanically connected to one or additional sets of touching contacts. It is detained in place by a spring so that when the relay is de-energized there is an air gap in the attractive route. In this state, one of the two sets of associates in the relay pictured is congested, and the other put is open. Other relays may contain extra or less set of associations depending on their motive. The relay in the image also has a wire between the armatures to the yoke. This ensures continuity of the circuit between the touching contacts on the armature, and the circuit track on the printed circuit board via the yoke, which is soldered to the PCB.

#### **a. ALARM**

An alarm apparatus or classification of alarm devices gives an audible, illustration or other form of alarm signal about a quandary or condition.

#### **b. LCD**

A liquid crystal display is an even sheet display, electronic visual display, or video display that uses the light modulating property of liquid crystals. Liquid crystals do not create light honestly. LCDs are accessible to display arbitrary images or fixed images which can be displayed or concealed, such as set words, digits, and 7-segment displays as in a digital clock. They use the matching basic technology, exclusive of those subjective images are through up of a bulky amount of small pixels, while other displays have better elements. LCDs are used in a broad range of applications counting computer monitors, televisions, gadget panels, aircraft cockpit displays, and signage. They are ordinary in customer devices such as video players, betting strategy clocks, watches, calculators, and telephones, and have restore cathode ray tube display in the majority applications. They are obtainable in a wider choice of screen sizes than CRT and plasma displays, and because they do not use phosphors, they do not experience image burn-in. LCDs are, however, exposed to image persistence.

### **7. CONCLUSION**

The data suggests a possible relationship linking high humidity, high dust levels and low air temperature with asthma symptoms. This is in keeping with the known negative impact of these factors on people with asthma and allergies and suggests a valuable role for air monitoring in asthma management. A principal components multinomial logistic regression classifier, we found that principal

components, Pollution and Climate, were able to successfully identify the presence of conventional smoking (with 99% accuracy) and cooking (with 89% accuracy), with a total classification accuracy of 95.7% across all the events (control, cooking, and smoking). The activities cooking and smoking lead to a perceptible change in the environmental parameters PM, VOC, CO<sub>2</sub>, temperature, and humidity. The parameters PM, VOC, and CO<sub>2</sub> were better predictors of the activity of smoking and cooking in comparison to temperature and humidity. The employ of such a replica will assist in continuous monitoring of indoor air quality and activity discovery within our asthma management framework involving end-to-end validation in a trial of 200 patient cohorts. Besides providing more training data for the present classifier, we recommend that future studies build upon this model towards the detection of other PM-inducing events which may exacerbate asthma symptoms such as the use of e-cigarettes, burning incense, sweeping, and the use of particular cooking methods

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