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MONITORING INDOOR AIR QUALITY FOR BETTER HEALTH BUILDINGS

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Abstract

Since most people spend 90% of their time indoors, the indoor environment has a determining influence on human health. In many instances, the air quality parameters are very different from those defined as healthy values. Using real-time monitoring, occupants or the building manager can decide and control behaviors and interventions to improve indoor air quality. The historical database is also useful in promoting medical diagnosis by helping physicians. In particular, continuous technical developments in networking, sensors and embedded devices have made it possible to track and provide assistance to individuals in their homes. Smart objects that have great sensing and connecting capabilities could revolutionize the way we track our environment.

Keywords: *Health care, Air, Environment, Indoor, Medical, Quality, Contaminants.*

I. INTRODUCTION

Indoor environments could be characterized by several pollutant sources. The Environmental Protection Agency (EPA) is responsible for environmental air quality index regulation. This independent organization considers that indoor levels of pollutants can be up to 100 times higher than the level of outdoor contaminants and has placed poor air quality as one of the top five environmental threats to the well-being of the community. Indoor air quality (IAQ) is thus recognized as an important factor for the health and comfort of the occupants to be monitored [1]. Increasing the IAQ is important because individuals usually spend more than 90% of their time in indoor environments. The issue of insufficient IAQ is of utmost importance, affecting especially severely the poorest people in the world who are most vulnerable, posing themselves as a major problem for global health, such as the use of cigarettes, alcoholism or the problem of sexually transmitted diseases. In 1983, as a result of the weak IAQ, the World Health Organization (WHO) used the word "sick building

syndrome" (SBS) to use the clinical characteristics that we could discover in building inhabitants [2].

The influence of IAQ in the parthenogenesis of various generic signs and medical outcomes explaining SBS has been stated in numerous statements. This pattern is commonly represented scientifically because it can include the skin (with xerosis, pruritus), the upper and lower respiratory tract (such as dysphonia, dry cough and asthma), the eyes (ocular pruritus), and the nervous system (for example, headache and difficulty in concentration). In addition, there are syndromes that may be associated with indoor environments, i.e. Legionnaires disease, extrinsic allergic alveolitis, asthma, and atopic dermatitis, besides the symptoms of this disease. For starters, it is a chronic and inflammatory skin disorder and one of the most common allergic syndromes in infants with atopic dermatitis. Its incidence is growing and, although it is related to genetic influences, there is a strong suggestion that environmental factors, including indoor air pollutants, are responsible. In developed nations, where young people spend much of their time inside houses, this is especially important.

Volatile organic compounds, like air pollutants, are related to the exacerbation of atopic dermatitis, which remains the ultimate intentional indoor air pollutant. Universally recognized, indoor air pollutants may cause oxidative stress in atopic dermatitis, leading to dysfunction of the skin barrier or immune regulation. Therefore, the symptoms and syndromes associated with "sick buildings" are a public health concern with emerging importance and have also been linked to lower productivity and greater absenteeism. Chemical toxins (both from outdoor and indoor sources), biological agents, mental difficulties, electromagnetic radiation, sunshine deficiency, temperature, poor acoustics, poor ergonomics, and poor ventilation may be included in the aetiology of the SBS and the building related disorders. While the relevance of indoor air quality to public health still exists, there is a lack of interest in developing countries in new research approaches for improving indoor air quality. In houses, ventilation is used to construct thermally comfortable conditions with an optimal IAQ by monitoring indoor air parameters, such as air temperature, relative humidity, air velocity, and air concentrations of chemical species [3].

An IAQ assessment framework offers an essential means of defining and enhancing the efficiency of the indoor climate. Local and distributed chemical concentration assessment is critical not only for protection (recognition of gas spills, monitoring of pollution) and well-being applications, but also for energy efficiency systems for effective temperature control, ventilation and air conditioning (HVAC). IAQ monitoring offers an uninterrupted stream of data for centralized regulation of building automation procedures, and delivers a solution for enhanced build management. Real-time supervision of the IAQ is assumed as an essential tool of extreme importance to plan interventions for enhanced occupational health. In the recent past, on behalf of environmental supervision, numerous systems have been built, constantly alongside the aim to increase the IAQ. For the integration of wireless communications, the accessibility of cost-effective, energy-efficient, and small-scale embedded computers, radios, sensors, and actuators, regularly integrated on a specific chip,

has been carried out to cooperate with the material world for IAQ monitoring and improved living environments. The authors present several new open-source and cost-effective systems that have been developed for monitoring environmental parameters, always with the aim of improving IAQ for enhanced healthy buildings.

II. IOT AND AAL FOR THE ENHANCED INDOOR AIR QUALITY

Ambient assisted living (AAL) is closely related to the necessity of pervasive healthcare supervision, and the main aim is to contribute to the pervasion of independence and well-being for older adults using Information and Communication Technologies. There are numerous AAL solutions nowadays that can be found in literature that integrate a large number of different kinds of biological supervision sensors. Usually, these systems integrate wireless networking technologies such as ZigBee, Bluetooth, Ethernet, and Wi-Fi for data sharing and collection. In the second half of this century, 20% of the human race would be 60 years of age or older, which is related to many complex public health issues. First of all, this would lead to a rise in illnesses, the budget for healthcare, and the lack of caregivers, leading to a major social effect. Another important argument is that people typically choose to remain in their homes even paying the cost of the nursing care, which indicates the research of AAL solutions architectures as unquestionably a subject of extraordinary significance taking into account humankind aging [4].

AAL researches are planned to encounter the requirements of the elderly population to preserve their independence as long as conceivable. On the only hand, enhancements in telecommunications, sensors, and embedded processors conducted to the delivery of actual-time supervising and personalized healthcare answers to entities that are capable of being presently used in their habitats. At the different hand, those incessant medical trends create the elaboration of smart cyber-physical structures for superior living environments and occupational fitness. despite the fact that there may be a part of issues within the introduction of an effective AAL ecosystem which include records architecture, interface design, human-pc communiqué, ergonomics, usability and availability, there also are collective and moral difficulties as the recognition by way of the older people and the privateness and confidentiality that might stand as a prerequisite of the absolutely AAL solution. Indeed, it's far likewise essential to guarantee that the era does no longer alternate human care however instead ought to be a notable praise [5].

The internet of things (IoT) stands as a standard wherein things are related to the net and incorporate statistics series capabilities. The basic concept of the IoT is the pervasive presence of a selection of gadgets with interplay and cooperation skills amongst them to reach a common goal. it is expected that the IoT will initiate a great effect on numerous characteristics of everyday life and this paradigm might be integrated in numerous purposes which include domestics, assisted living, e-health wireless and is likewise a great emergent expertise to provide novel evolving records and computational resources on behalf of generating groundbreaking software packages. IoT architectures must comprise wireless

conversation technology. Nowadays, numerous wireless conversation technologies are to be had including Bluetooth-primarily based technologies, primarily based technology, near field verbal exchange (NFC)-based technologies, and GSM-based total technology [6].

IoT solutions must stand pervasive, be context aware, and allow environment intelligence skills that are directly connected to AAL. IoT is an appropriate method to construct well-being solutions. Scientific developments turn possible to create novel and innovative instruments to empower real-time healthcare supervising solutions for decision-making in the management of several syndromes. Nowadays, several IoT architectures have been implemented for clinical monitoring that claim IoT as a reliable platform to develop personalized healthcare systems. Due to Bluetooth technology, the use of wearable's for data collection and smartphones for data transmission is now possible to provide physiological parameter supervision.

III. CONCLUSION & DISCUSSION

This paper has presented several solutions for indoor air quality monitoring and decision-making tools for enhanced healthcare. Using open-source technology, cost-effective sensors, low construction costs, installation, modularity, scalability, and easy access to data monitoring, all the provided solutions were built. The outcomes of these solutions are auspicious, since this form of system will be used to provide a comprehensive stream of data that can be used by the building manager for proper maintenance to provide not just a stable but also a balanced atmosphere for better living environments. On the one hand, real-time tracking is an effective way for medical specialists to promote clinical analysis, as the therapeutic team could examine the background of IAQ symptoms in the setting in which the patient lives and relate those data to his health issues. On the other hand, it is conceivable to effectively recognize poor air quality conditions and prepare strategies for better living environments by supervising IAQ.

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