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Data Processing of an Embedded System for Environmental Quantitative Estimation

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Introduction

Improving the quality of our environment is an important topic today, especially in light of global warming and the presence of greenhouse gases. The quality of work environments is one of the areas of focus that has a significant impact on human health. These issues are related to workplace hygiene and the types of environments in which people work. Carbon dioxide concentrations have become increasingly closely monitored in recent years, as higher levels of this gas can reduce labour productivity. These concerns are also very relevant in educational settings. Students' concentration and attentiveness in class are important factors in this regard.

Carbon dioxide concentration has an impact on overall air quality. CO_2 concentrations in interior rooms should be less than 1000 ppm. Excessive concentration has a negative impact on mental performance and concentration, and at high levels can cause headaches and fatigue [1-2]. Severe health risks are imminent if a concentration of 5000 ppm is exceeded. describes the device first introduced in and used to measure atmospheric pressure, temperature, relative humidity, and carbon dioxide concentration.it describes the measurement chain for monitoring carbon dioxide in the department where the authors work in great detail. There is no detailed description of the measurement chain or statistical analysis of the data.

Description

There are several types of CO_2 sensors on the market. They are typically simpler sensors that display the measured level of CO_2 concentration via a colour LED. Some sensors also allow for relative humidity measurements. These sensors are powered by alkaline batteries and/or an AC adapter. There are also sensors that display the level of measured CO_2 concentration. When the set CO_2 concentration limit is reached, some sensors have a relay output that activates, for example, ventilation. These simpler sensors are not connected to wireless networks. These sensors cost between 100 and 360 EUR. An example of such a sensor can be found here. The use of this type of sensor in describes the use of this type of sensor in the form of a data logger. However, data analysis is only briefly mentioned.

More complex and expensive sensors already support wireless communication, such as Bluetooth or Wi-Fi with a mobile phone. This wireless communication, however, is only peer to peer. The ability to display the current measured values on the display of a mobile phone or tablet is an advantage. It is also possible to see historical trends and, in some cases, to trigger an event when the measured value is exceeded. The disadvantage is that it consumes more power and thus has a shorter battery life. Sensors for the Z-Wave standard, for example, are also commercially available. There is a sensor that measures CO_2 concentration, temperature, and humidity for this technology [3,4], which is specifically designed for building automation. It cannot measure atmospheric pressure, unlike our wireless sensor, and it cannot operate on batteries. Wireless sensors are primarily intended for use in existing "intelligent" buildings, particularly schools that are not equipped with industry building automation standards such as KNX. As a result, our environmental sensor has been designed as a wireless sensor that can be used to build a large wireless sensor network without requiring any building modifications to existing structures [5].

Conclusion

Sensors with IoT network connectivity, such as Sigfox or LoRa (collectively referred to as LPWAN), are also commercially available. Due to the high cost of individual licences, most commercially available Sigfox-based systems are unsuitable for large wireless sensor networks. Commercial solutions based on LoRaWAN technology, such as the GlobalSat LS-111, ref., are dependent on the provider's infrastructure, which typically charges additional fees. As a result, these solutions are unsuitable for monitoring multiple rooms within a building. For example, ref charges 1 EUR per month for a device that sends at least one message per day. This solution, on the other hand, only includes 100 historical values and a web interface with basic charts.

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