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URBAN NOISE NUISANCE MONITORING USING LOW POWER WIRELESS ACOUSTIC SENSOR NETWORKS

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Abstract:
Noise pollution or noise disturbance is the disturbing or excessive noise that may harm the activity or balance of human or animal life. The source of most outdoor noise worldwide is mainly caused by machines and transportation systems, motor vehicles, aircraft, and trains. Outdoor noise is summarized by the word environmental noise. Poor urban planning may give rise to noise pollution, since side-by-side industrial and residential buildings can result in noise pollution in the residential areas.Indoor noise can be caused by machines, building activities, and music performances, especially in some workplaces.

Keywords – Noise pollution, Indoor, Urban.

1. INTRODUCTION

Noise-induced hearing loss can be caused by outside (e.g. trains) or inside (e.g. music) noise. High noise levels can contribute to cardiovascular effects in humans and an increased incidence of coronary artery disease. In animals, noise can increase the risk of death by altering predator or prey detection and avoidance, interfere with reproduction and navigation, and contribute to permanent hearing loss. Exposure to excessive noise levels is known to negatively impact quality of life. These effects, though largely subjective, can be broadly categorized as annoyance (affective-emotional response), affected concentration, communication disturbance and sleep disruption. While instances of sleep disruption and affected concentration (represented by interruption of an activity in response to a noise occurrence) can be measured, annoyance is determined based on the perception of given sounds or as a consequence of the former effects. Further to this, exposure to excessive noise levels is known to have detrimental health impacts (at sound pressure levels above 65 dB). Noise pollution affects both health and behavior. Unwanted sound (noise) can damage psychological health. Noise pollution can cause hypertension, high stress levels, tinnitus, hearing loss, sleep disturbances, and other harmful effects. Sound becomes unwanted when it either interferes with normal activities such as sleeping, conversation, or disrupts or diminishes one's quality of life. Chronic exposure to noise may cause noise-induced hearing loss. Older males exposed to significant occupational noise demonstrate more significantly reduced hearing sensitivity than their non-exposed peers, though differences in hearing sensitivity decrease with time and the two groups are indistinguishable by age 79. A comparison of Maaban tribesmen, who were insignificantly exposed to transportation or industrial noise, to a typical U.S. population showed that chronic exposure to moderately high levels of environmental noise contributes to hearing loss.

2. LITERATURE SURVEY

Noise pollution caused by vehicular traffic is a common problem in urban environments that has been shown to affect people's health and children's cognition. In the last decade, several studies have been conducted to assess this noise, by measuring the equivalent noise pressure level (called *L*eq) to acquire an accurate sound map using wireless networks with acoustic sensors. However, even with similar values of *L*eq, people can feel the noise differently according to its frequency characteristics. . Nevertheless, these networks and their applications are still far from being mature, due to the constraints on resources such as energy, memory, computational speed and communications bandwidth. In the last decade, several studies have been conducted using WSN for noise pollution .

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All of these studies are based on the equivalent sound pressure level over time *T* (denoted by *Leq,T*). Although these measurements provide sufficient information about the noise level, they fail to provide enough information related to the subjective annoyance. In 1996, Greater Lyon wanted to set up, with five public research centers, an urban noise observatory by creating an entity specialized in environmental acoustics: acoucité. In 2002, a permanent noise measurement network was created, and in 2007, the city published its noise maps in accordance with 2002/49/EC. In 2008, acoucité published a first methodological guide, and in 2010, the French Ministry of Ecology announced a financial support to the noise observatories. Four cities were selected: Aix en Provence, Grenoble, Nice, and Saint-Etienne. In partnership with acoucité, these cities had already made their noise maps and drawn up the action plans to reduce noise.

3. PROPOSED SYSTEM

In this system consists of wireless transmitter and receiver. The transmitter contains dynamic high sensitive microphone, signal conditioning unit, atmega16 controller and ISM 2.4GHz RF transceiver. The high gain microphone can be used to converts the observed noise signal into electrical signal.

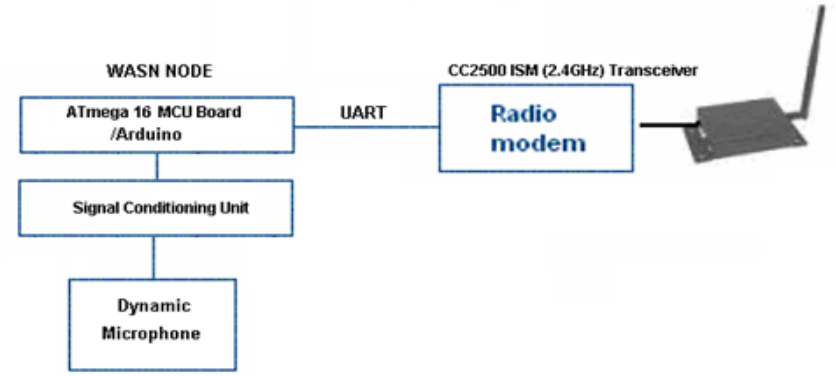

Fig.1.Block diagram of transmitter

The electrical output of the microphone is in low amplitude level and it applied to the input of the signal conditioning unit. The operational amplifier IC 741can act as a signal conditioning unit which is used to increase the amplitude of the input signal is in required level. The operational amplifier output is applied to atmega16 controller. This controller can executes the corresponding program for indicating the gain level of the noise according to their received input level from signal conditioning unit. The output of the controller is applied to the input of RF transceiver through UART. The RF transceiver is used to transmit the data's about the noise to receiver. The ripple content in the rectifier output is smoothened by adding a

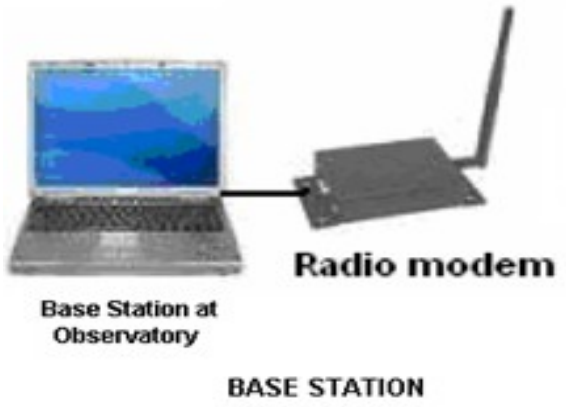

Fig.2.Block diagram of receiver

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capacitor filter in parallel to the output. The value of capacitor may be from 100 to 4700 microfarads. Higher the chosen value more is the filtering.

4. RESULT ANALYSIS

In 2008, the C Standards Committee extended the C language to address these issues by providing a common standard for all implementations to adhere to. It includes a number of features not available in normal C, such as, fixed-point arithmetic, named address spaces, and basic I/O hardware addressing. Embedded C use most of the syntax and semantics of standard C, e.g., main () function, variable definition, data type declaration, conditional statements (if, switch. case), loops (while, for), functions, arrays and strings, structures and union, bit operations, macros, unions, etc. As time progressed, use of microprocessor-specific assembly-only as the programming language reduced and embedded systems moved onto C as the **embedded programming language** of choice. C is the most widely used programming language for embedded processors/controllers. Assembly is also used but mainly to implement those portions of the code where very high timing accuracy, code size efficiency, etc. are prime requirements. Embedded systems often do not have a console, which is available in case of desktop applications. So, what basically is different while programming with **embedded C** is the mindset; for embedded applications, we need to optimally use the resources, make the program code efficient, and satisfy real time constraints, if any. All this is done using the basic constructs, syntaxes, and function libraries of 'C'. In macros you can use all characters from keyboard and any ASCII char if you use $xx or #xxx. Where $xx is hex and #xxx dec format of ascii code. If you want to use # or $ char in macro you should type it twice ($$=$ and ##=#). If you'd like to store macro in macro list (up to 10 in each) just click with right mouse button and chose "save macro". Active macro is "saved" even if you don't save it and will be available next time when you'll start Terminal. Macro string can be up to 128 characters long. The RTX166 real-time operating system is a multitasking kernel

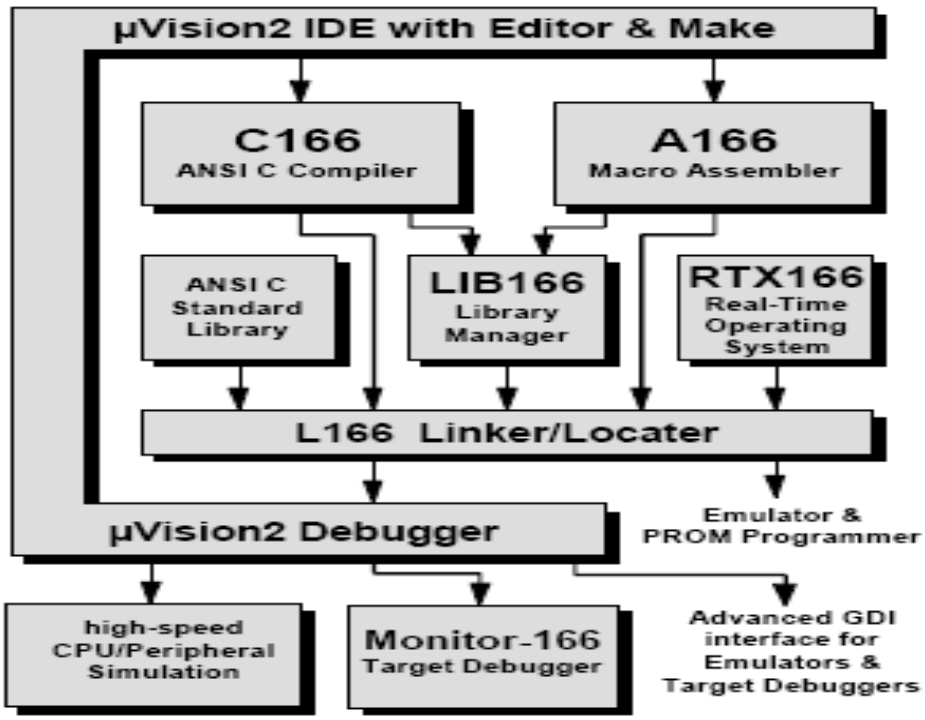

Fig.3.Funcional blocks of Keil

for the 166 family. The RTX166 real-time kernel simplifies the system design, programming, and debugging of complex applications where reaction to time critical events fast is essential. The kernel is fully integrated into the C166 compiler and is easy to use. Task description tables and operating system consistency are automatically controlled by the L166 linker/locator.

CONCLUSION

A novel scalable multi-tier architecture for continuous monitoring of noise in urban environment is presented. The designed hardware platform processes the noise signal in analog domain and converts it into sound levels ensuring privacy protection. Visualization and interpretation of the data is achieved using Google maps. The qualitative and privacy challenges using participatory sensing in the context of noise monitoring is discussed. An end-to-end research and development including architecture, hardware platform, data management and interpretation is demonstrated with real-time experiments.

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