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ENVIRONMENT SENSING USING SMART PHONE

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ABSTRACT

Mobile devices (in particular smartphones and tablets) can be used to monitor quality of life parameters. Today mobile devices use embedded sensors such as accelerometers, compasses, GPSs, microphones, and cameras without considering, for example, the air quality or the pollutants of the environment. This paper presents the possibility to use the smartphones capabilities to gather data from other phones or sensors. Nowadays, monitoring climate condition's parameters such as temperature and humidity is a prominent factor to control the changes of the environmental condition of living or working places for the human being. This point can be obtained by using distributed devices in different environments that containing high-resolution sensors and a wireless transmission apparatus for transferring data to smartphones. The Bluetooth was chosen as a transmission tool since it is embedded in all smartphones and it can work in the absence of the Wi-Fi connection. Smartphones are the programmable tools to have different kinds of applications that allow communicating with other devices and also gathering, analyzing and verifying data. In this paper, a novel interface by applying a Bluetooth-based sensor to sense Temperature and Humidity for monitoring of the environmental conditions using the android-based smartphone is introduced. The rapid advancement of smartphone technology has transformed these devices into powerful tools for environmental monitoring. Equipped with built-in sensors such as GPS, accelerometers, gyroscopes, cameras, and microphones, modern smartphones can collect real-time environmental data. This project leverages smartphones as cost-effective, portable, and widely available platforms for environmental sensing, focusing on applications such as air quality monitoring, noise pollution detection, temperature and humidity measurements, and geospatial data collection. The proposed system integrates smartphone sensor capabilities with data analytics to provide users and stakeholders with actionable insights. Data is collected through sensors and augmented by external peripherals, such as portable air quality monitors or temperature probes, when needed. Machine learning algorithms and data visualization tools process and present this data through a user-friendly mobile application. The application also allows for crowdsourcing, enabling large-scale environmental data collection and analysis. Such systems can aid in urban planning, public health initiatives, and environmental widely available platforms for environmental sensing, focusing on applications such as air quality monitoring, noise pollution detection, temperature and humidity measurements, and for crowdsourcing, enabling large-scale environmental data collection and analysis. Such systems can aid in urban planning, public health initiatives, and environmental conservation efforts, fostering a more sustainable and informed society.

INTRODUCTION

The cell phones are one of the inseparable parts of the people life for contacting each other via text and voice. Insides, Personal Digital Assistant (PDA) has more facilities such as check mail, play game, send and receive file, etc. that allows the user to have more services. The combinations of abilities of these two mentioned devices brought up the new devices called smartphone that can work with different kind of applications depending of their operating systems. Today, smartphones are the equipped devices that are used in many different sectors such as business, healthcare, social networks, environmental monitoring, safety, and transport. For enabling related application to consider different domains, a set of embedded sensors such as accelerometer, compass, gyroscope, GPS, microphone, and camera are directly included to smartphones. The orchestration of the computing, communication, and sensing capabilities of the smart type of mobile phone enables participatory or opportunistic operations . In the case of moving, there are two types of sensors: first, the wearable sensors that are wore by people. Some devices are capable to connect and transfer data, as an IP based system, with devices via Bluetooth such as PDAs and cell phones; also in some projects the use of memory cards as a data storage are considered. Their cellular phone send periodically the data sensed on their own condition to a central database. Bluetooth based system are not so reliable to have a continuously connectivity in this scenario. Second, Phone mobile to Web1: using mobile phone for the personal reflection on environmental impact. Te phone records and uploads location every few seconds to a secure server. Based on these location-time traces and also tagging the activities (such as walking, biking, driving, etc.), the system can give to the users environmental information . In some cases there is no possibility to use camera or text messages for gathering information, for example in moving situation (such as bicycling or driving) . In the case of Phone mobile to Web there is another option for monitoring changes, for h-instance the participants use their mobile phone to take a picture from certain locations and then upload these pictures to the web portal. Moreover, mobile phone and Web can use to provide information about behaviors, life style, and medical situations of elders to their family and doctors. The following parameters will be affected on the sensors structures and subsequently their platforms:

- Deployment (activities)
- Location (indoor / outdoor)
- The application
- Data (that should be processing and inferring)

These different scenarios to monitor the environment using wireless sensor networks can be accomplished via personal, group and community. It is worth to know that the mixed of the following approaches is possible. Having environmental information is simpler today with above scenarios in the case of moving. Monitoring temperature and humidity of an environment of some fields such as medical, social services, and agriculture are useful for controlling and consequently alarming. In the

SYSTEM MODEL

authors proposed a temperature sensing mobile robot as a solution for temperature measurement that applied in airport and hospital.The system model of our prototype is as shown below

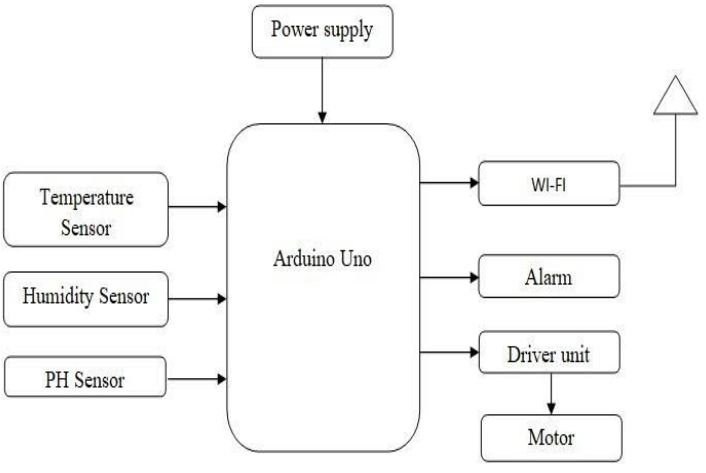


FIGURE 1 :

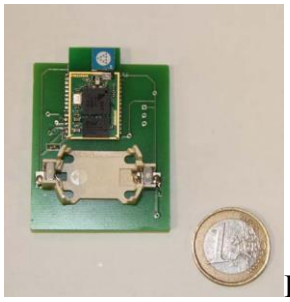
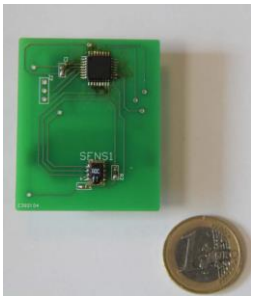
A)  B) 

Figure1. The electronic circuit of the Bluetooth-based temperature and humidity acquisition system. (A) Top view of the device: the battery holder and the Bluetooth module are clearly visible. (B) Bottom view of the device: the temperature and humidity sensor and the microcontroller are evident.

A. Bluetooth-based temperature and human acquisition system

The Bluetooth-based temperature and humidity acquisition system consists of a device comprising a sensor and a microcontroller that wirelessly transmits these climatic parameters to a receiver using the Bluetooth communication system.

B. Smartphone Application

There are a number of smartphone platforms for developers, such as iOS, Symbian, Android, and Windows Mobile. The iPhone with the iOS operating system was the first choose of this research but rejected because of limitation of the Apple on using hardware for programming specially with the ports related to the Bluetooth. The Apple just allows to the commercial program to communicate via Bluetooth with non- Apple devices based on an agreement. The android has been chosen in this paper since it is easy to customize and open to work with different hardware specially Bluetooth [11][12]. The Android software development kit (SDK) version 13 with the ADT Plug-in for Eclipse was applied for this research. The android SDK's emulator was helpful to test the UIs (User Interfaces) before installing on the mobile phone. An application called aBluSen was developed to acquire data from the Bluetooth-based temperature and humidity acquisition system that has described before.

FIGURE 2 :

Figure 2. The *display* part of the aBluSen application for showing the temperature and humidity values that obtained from the Bluetooth-based acquisition system**.**

C. Experiment

The reliability of the estimates provided by the Bluetooth- based temperature and humidity acquisition system, and acquired by the smartphone application, was investigated during a laboratory experiment. The device was placed in a climatic chamber (Angelantoni - Challenge 250; temperature range for climatic test from -40°C to +180°C), which allows controlling environmental conditions. At the beginning of the experiment, the system was placed in the climatic chamber with the temperature of 25°C and humidity of 50%, for approximately 10 minutes. Then, the climatic chamber was arranged to reach -20°C with a temperature gradient of -0.5°C per minute. The humidity was left free to change during on this period of time.

RESULT

Temperature and humidity values (raw data) that are obtained by the file saved by the android-based application from the Bluetooth-based temperature humidity acquisition system during the experiment, are shown in Fig. 3. Temperature values obtained by the system correctly follow the temperature condition provided by the climatic chamber, and descript in the previous section. The humidity values for temperatures higher than 0°C are nearly at 50% as imposed by the climatic chamber. However, the climatic chamber cannot impose the

CONCLUSION:

This paper investigates a novel approach to acquire temperature and humidity signals using relative low cost and low power components and the Bluetooth communication system for the transmission of the acquired data to an androidbased smartphone. An application for the acquisition and storage of temperature and humidity values was created for the android's smartphone. The performance of the entire system was tested by laboratory tests using a climate chamber in order to modify the environmental conditions. Results shown that the presented device correctly follows the environmental condition which created by the climatic chamber and the application for the smartphone properly acquired and stored the data by the apparatus using the Bluetooth connection as a transceiver. This approach is useful to monitor climate condition for small environments, such as a laboratories, home rooms, medical spaces, etc., and turn on alarms when the condition changes or overlaps some fixed thresholds. Another possible application of the presented system is the detection of fire in small environments. Future work will be focused on the miniaturization of the device, by using a smaller temperature and humidity sensor and a microcontroller including radio part of the Bluetooth module which needs only for the external antenna. Other work will be focused on reducing of the power consumption of the device, modifying the use of the Bluetooth protocol. Moreover, the application for the smartphone will be improved on features and exported in other mobile phones' operating systems such as Symbian or Windows Mobile.

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