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Android based Remote Monitoring System

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ABSTRACT

Today for real time applications it is important to monitor system in efficient way which puts limit in terms of accuracy and repeatability if a human is employed on plant to do this task. The traditional automated monitoring (surveillance) systems are wired and larger in size. It mostly uses only PC as a surveillance terminal, which works efficiently but does not give portability. The proposed system describes an intelligent Monitoring System which is based on android platform gives facility to access monitored parameters quickly on mobile handsets anywhere from the world.

As the mobility provided by the mobile phones and the application supportability given by the android system over 2G and 3G network there are infinite possibilities to expand monitoring system.

Keywords

Remote Monitoring System with Android, Data Acquisition with Android, Surveillance system using PIC microcontroller, Android.

1. INTRODUCTION

By now, there is a mature market for such kind of surveillance system and its cost is relatively high. However, it can't meet the surveillance needs for moveable or place which has not strict needs on performance and reliability[1]. In facts, such kind of needs is becoming more and more intense to some instant. With the development of 3G technology, wireless bandwidth is larger, which makes it possible to develop more content-rich applications for mobile phone, such as video, audio and digital data and provides a basement for the realization of wireless smart surveillance system at the same time.

Android is an open source phone operation system based on linux platform and it's the first truly open and complete mobile software for mobile terminal[4]. In order to solve the shortcomings of traditional surveillance system, this project proposed a surveillance scheme based on android smart phone, which makes it possible to monitor target site in anywhere and anytime via android smart phone under the coverage of wireless network.

This project proposed a monitoring scheme prototype based on android smart phone terminal. By collecting and processing data at server, sending data to smart phone terminal via Web Services[7], it reaches the purpose of monitoring the target site anywhere and anytime under the coverage of wireless network and enhances the flexibility of surveillance system greatly.

2. PROPOSED SYSTEM

This complete system is divided into four distinct parts:

1. Sensor Expansion Board.
2. PIC18F4550 Mother Board.
3. A dedicated PC working as Database Server.
4. Android compatible Mobile loaded with App that supervises the system's Parameters.

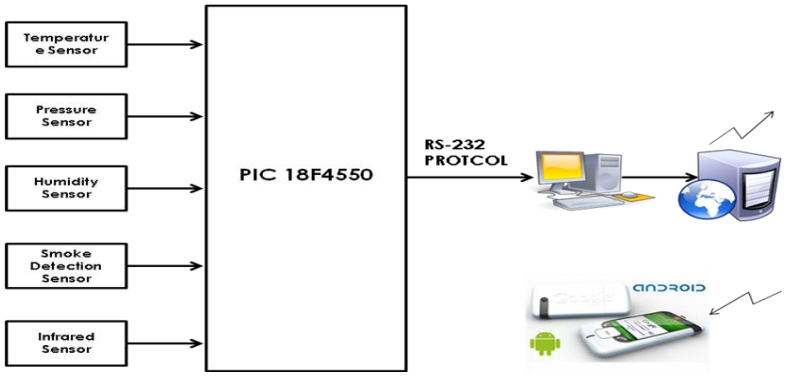

Fig 1: Proposed system

For this system the input is take form the sensors. These sensors will provide the analog as well as digital data. In this system PIC 18F4550 is used which supports both input data.

Monitoring is done on mobile or Desktop (using chrome explorer). As per the application or environment the sensors can added or removed.

3. HARDWARE DESIGN SYSTEM

Hardware Design of the system is divided into following parts:

1. Sensor Expansion Board
2. PIC18F4550 Motherboard

1. Sensor Expansion Board:

Even though Sensors converts physical parameters such as pressure, temperature[9] etc. into their equivalent electrical parameters these are sometimes not in compatible with PIC. Hence Sensors input are fed to PIC microcontroller via sensor expansion board.

2. PIC18F4550 Motherboard:

PIC18F4550 [6] is a Microchip's microcontroller having inbuilt ADC which has a very high resolution of 10-Bit which maintains accuracy capable of handling 13 channels which gives flexibility to user to expand his system to make it powerful.

4. SOFTWARE DESIGN SYSTEM

Software required for proposed System are:

1. MPLAB IDE by Microchip
2. Application of JAVA & XML using Eclipse Environment.
3. MySQL database server
4. Android development tool by Google.

MPLAB IDE:

It is Integrated Development Environment a product of Microchip which gives a facility of Editor, compiler, Debugger, Programmer in order to program PIC microcontrollers using either Assembly language or High level language such as Embedded C. The code written in Embedded C enables microcontroller to sense many analog channels continuously with specific interval as programmed, after accepting these analog data it converts into 10-bit Digital value. Using UART module this digital data is sent to a Computer which acts as a dedicated server accepts data from microcontroller via RS-232 port.

Appilcation of XML and JAVA:

Java Code needs to be written to accept data coming into RS-232 port in ASCII form using packages by importing as follow

```
import gnu.io.CommPortIdentifier;
import gnu.io.PortInUseException;
import gnu.io.SerialPort;
import gnu.io.SerialPortEvent;
import gnu.io.SerialPortEventListener;
```

This packages imported provides necessary methods to access serial port which belongs to LINUX.

Once data is accessed it is simultaneously stored into My-Sql by importing following pacakages

```
import java.sql.Connection;
import java.sql.PreparedStatement;
import java.sql.ResultSet;
import java.sql.SQLException;
import java.util.ArrayList;
```

Now this data which stored into My-Sql in the form of table is converted into Web Services using XML. XML stands for Extensible Mark up Language which is designed to store and transport data. It simplifies data sharing, change of platform anytime and availability of data whenever required. Once web services are made its possible to access it using Android tool.

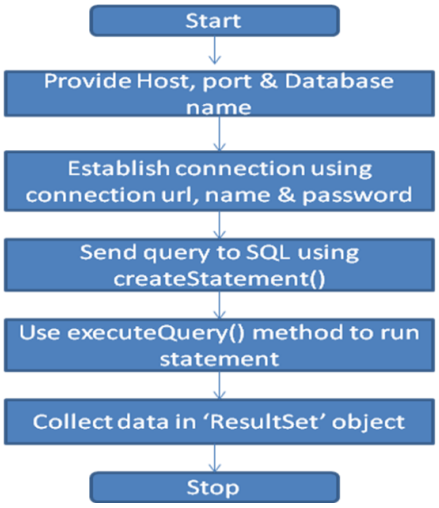

Fig 2: Procedure to establish connection with MySQL

Android Development Tool by Google:

A. GUI Design:

Fig 3: Graphical User Interface

For android, there are two methods to design interface layout: one is via java; the other is via xml file[8]. Though the speed of parsing an xml file is slower than a java file, it's not good for maintenance of later works if mixed the interface layout code together with the corresponding Activity logic code. From the view of software design[2], the second method meets the basic requirement of low coupling and high cohesion. Therefore, this system uses xml file to implement interface layout. In xml file, it can meet the needs of system.

GUI design by using <AbsoluteLayoutl>, <Button/>,<TextView/>, <ImageView>[10]

B. Declaration of Activity:

AndroidManifest.xml is a file that every application needs and it locates in the root directory of application. The intent filter of this xml file describes how and when to start an Activity. Any Activity defined by user must be declared in this file by using <Activity></ Activity> label or the application wouldn't be able to start this Activity normally[3].

C. Sensor Activity Design:

For android, an interface is corresponding to an Activity and all of the transaction logic operations on interface are implemented by Activity class. In this system, the Activity corresponding to interface of displaying sensor data is Sensor Activity.[5]

5. RESULT

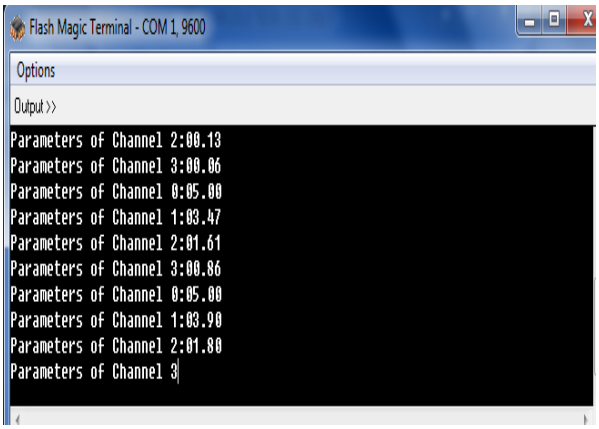

Fig 4: Access of Data on Virtual Terminal

Result above shows how data serially comes to COM port. It is then accessed by JAVA code and converted into Web Services and thereafter monitored remotely using Android.

Here Channel 0 belongs to Temperature

Channel 1 refers to Smoke Detector

Channel 2 refers to Level Detector

And Channel 3 refer to Humidity Detector

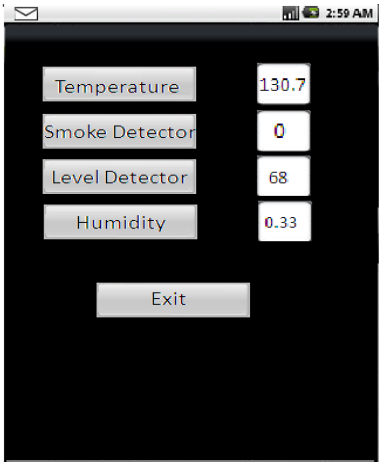

Fig 5: Display of data in Android GUI

6. CONCLUSION

In this paper a smart Remote Monitoring system is explained which does data acquisition from various channels in analog form digitizes it in high 10-bit resolution. Thereafter stores into database server.

This paper puts forward an innovative idea of making GUI in android application which can access data stored in dedicated web server anywhere from the world just by touch of ones. A build application is user friendly and more importantly a complete monitoring system is portable that one can carry in mobile phone.

A proposed system can be expanded for applications such as Healthcare or Industrial plant monitoring system where real time monitoring is required. With 3G and forthcoming 4G technology it is also possible to monitor the plant LIVE in Video form due to increased bandwidth and faster data rates.

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