

Food Spoilage Detection System using Android

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Abstract: Food poisoning is the major concern now a days. Ever since the packed food items are introduced we can't guarantee the freshness of food item. Now a days we are hearing so many complaints about food poisoning in restaurants and hotels because of the continuous degradation on quality of food. Keeping this in mind an embedded system for checking the quality of food is designed. This paper tells about the functioning of the model designed for checking whether the food which you are going to eat is healthy or not. It is a real-time food monitoring system for the smart phones. The smart phones gets data (PH of food) from the sensor interfaced with the microcontroller. The sensed data is then sent to the smart phone via Bluetooth. Android Platform is used for smart phone [1]. This system provides an affordable quick solution that can be used at any place where food is served. It helps people to know whether the food is healthy or not thereby preventing them from different diseases caused by food. In this project, Android smartphone and a Bluetooth interfaced with microcontroller are used to acquire the PH value.

Key words: ARM7 microcontroller, Android App, PH sensor, Bluetooth, Amplifier PH meter.

I. INTRODUCTION

Embedded systems provide solutions for various problems one of which is bio-medical applications. Advanced data management, processing, communication and human computer interface are executed using an android OS smart phone. Smart Android Phones are mostly accessed all over the world, they provide convenient system for self-monitoring the things which are at remote locations [4]. This system is used for remote assistance of the customer, so that he can come to know about the freshness of food. Experimental results shows how data is sensed then processed in the android platform, both hardware and software implementations are included in the paper. In this project, we use a Bluetooth enabled hardware device to send the PH of the food item to the Android smart phone [5]. The system manifests the design and implementation of a sophisticated embedded system which targets continuous monitoring of the parameter of food responsible for its freshness with a wireless interface ability to send the data to mobile device. Our main objective is to provide a solution to the food related problems like food poisoning, other diseases caused by consuming unhealthy food kept for long time. The effectiveness and accuracy of the system is its advantage. The architecture of the system consists of food monitoring sensors(which senses the parameters of food,PH in this case),a PH probe,PH meter, Bluetooth module, all controlled by a single microcontroller roller core.

Embedded systems mainly concerns with microcontrollers, in this system ARM7 microcontroller is used for interfacing sensors. Microcontroller platform is used for processing of data sensed by the sensor and is sent to the android device using Bluetooth protocol. The phone exhibiting the android OS will receive the data and provides a graphical user interface to tell about the food. Android OS is an open source OS with SDK (Software development kit) which help the user to have so many options for developing an android app.The smart android phones are the embedded system which can be used for so many tasks. Also it can be easily available and is in the reach of common man.

II. METHODOLOGY

A. Working principle

The following block diagram is self-explaining. First of all the PH sensor is sensing the PH and with the help of PH detection meter circuit using amplifiers, the voltage value is fed to one of the ADC of LPC2148 ARM7TDMI microcontroller since the value sensed by the sensor is analog. A Bluetooth module HC-05 is connected to the microcontroller and it will transfer the sensed PH value to a smart phone working on android OS and the android app will process the data that is it will compare with the existing database for the corresponding food item and display message whether the food is healthy or not.

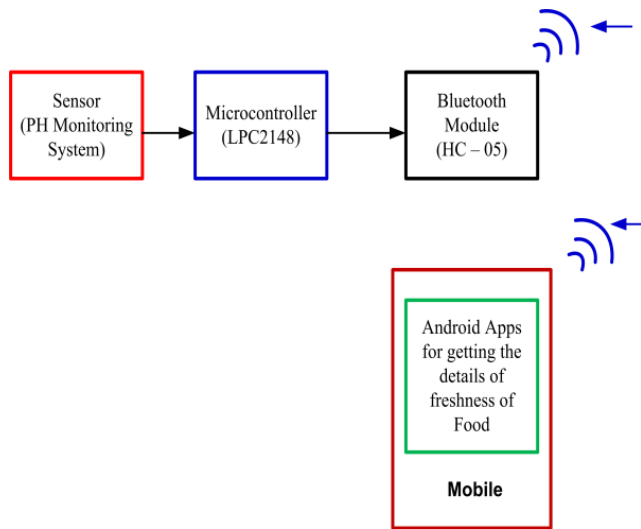


Fig. 1. : Block diagram of the system.

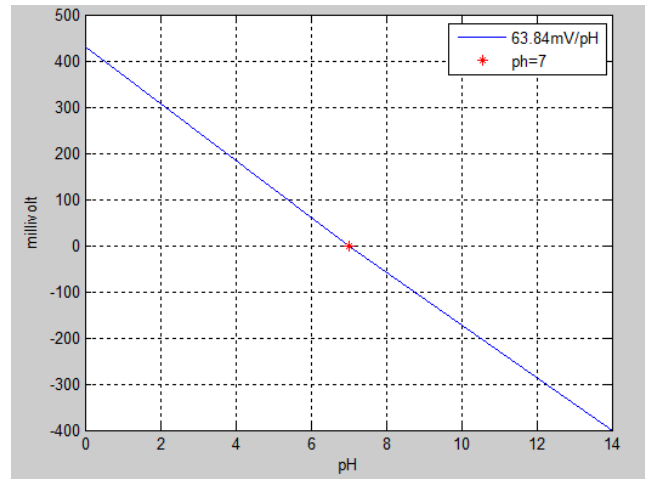


Fig. 2. : Graph which gives PH/mv value for the pH sensor used in the project.

III. DESCRIPTION

HARDWARE SYSTEM

PH sensor

It has an electrode made up of glass and a reference electrode (calomel electrode), used to measure the PH of semi-solid and liquid items. A PH meter is a device which is used along potentiometer to measure the pH, which is basically hydrogen ion concentration that is the hydrogen ions activity in an aqueous solution. Basically the pH meters measure the voltage difference between two electrodes. For a standard PH meter the voltage produced is approximately 0.06 volts per PH unit. A PH electrode is a high resistance single battery cell in which the voltage produced is proportional to the hydrogen ion concentration of the solution shown as –

$pH = -\log_{10}(ah)$

For an ideal PH sensor

- ❖ The output voltage is 0 volts for PH =7.
- ❖ The output voltage is positive for PH >7.
- ❖ The output voltage is negative for PH <7.
- ❖ The range for PH meter is 0(strong acid) to 14(strong base).
- ❖ Voltage generated per pH unit varies from -54mV@ 0oC to -74mV@ 100oC.
- ❖ If PH electrode generates -59mV/pH then the range will be +/-7*59mV or +/- .414volts.
- ❖ In this project the probe generates the slope of - 63.84mV/pH as shown in graph-



Fig. 3: A pH measurement system

Table1: The permissible range for PH of a food item

S. No	Food Items	PH Range
1.	Lemon juice	2 - 2.5
2.	Corn soup	6.0 - 6.2
3.	Milk	6.2 - 6.5
4.	Curd	4.7 - 4.9
5.	Paneergravy	5.6 – 5.7
6.	Chickengravy	5.6-6.8

Microcontroller

The microcontroller used in this project is LPC2148 which is an ARM7TDMI-S, all the hardware

components are connected and controlled by the microcontroller. LPC2148 founded by NXP (Philips) is a 32-bit high performance RISC with 512 on-chip flash ROM and Thumb extensions with In-system programming and IN-Application programming, it has 32-KB RAM, two 10 bit ADCs with 14 channels, USB 2.0 full speed device controller, two UARTs, two I2C serial interfaces. Vectored Interrupt Controller, Two 10bit ADCs with 14 channels, USB 2.0 Full Speed Device Controller, Two UARTs. To interface the analog sensor, LPC2148 uses two ADC modules-ADC0, ADC1.

LPC2148 has two ADC modules-ADC0, ADC1.

- ❖ Each having 10 bit resolution, uses SAC (successive approximation conversion) ADC technique.
- ❖ It supports 4.5MHz clock.
- ❖ Total ADC channels are 14(ADC0 has 6 and ADC1 has 8 channels).
- ❖ The registers used for ADC conversion-ADC control register (AD0CR or AD1CR) and ADC global data register (ADGDR).

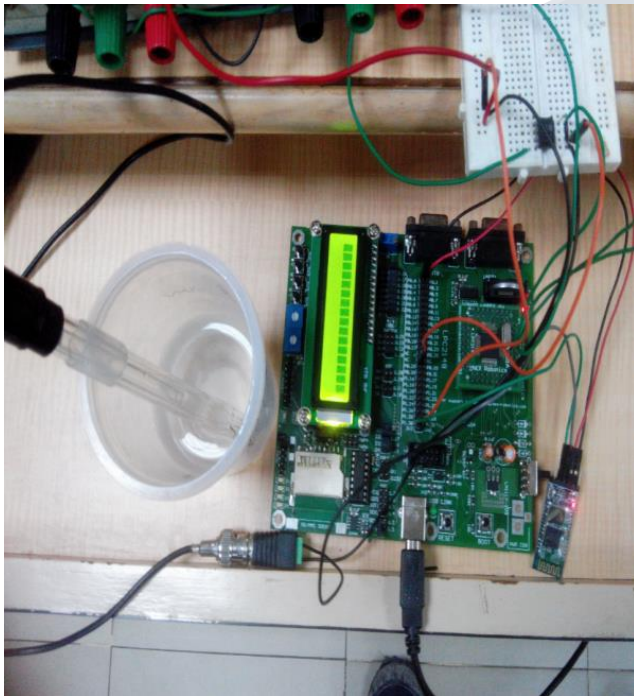


Fig4: Hardware of the system

Bluetooth

HC-05 is a serial port Bluetooth module which has V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation and works on the frequency of 2.4GHz radio transceiver and baseband. HC-05 uses CMOS technology and CSR Blue core and Adaptive frequency hopping feature with 4-External single chip system.

Hardware Features

- ❖ It can transmit upto +4dBm RF power.
- ❖ The HC-05 has operating voltage of 3.3V-6V with the baud rate range of 2400-115200bps.
- ❖ It gives UART interface with programmable baud rate.
- ❖ It comes with an integrated antenna.

SOFTWARE SYSTEM

For microcontroller ADC module programing is done in KEIL µvision development environment. ADC conversion is done and is transmitted via serial port using Bluetooth. The ADC registers are used for conversion of analog input value and then the final value is changed into pH using the below equation-

$$pHValue = (7.0 - (ADC_Data1/63.84)) * 100.0;$$

ADC_Data1 is the converted analog value. For android programming Android studio is used. In android, the app consists of a spinner and a textbox in which the pH value is received through Bluetooth. For creating database, a class called SQLite database is connected with main class [3]. For Bluetooth programming the following is used- Package- android.bluetooth

The above package provides Bluetooth classes-

- ❖ Bluetooth Adapter class(scan for other BT devices)
- ❖ Bluetooth Device(to get list of all paired devices)
- ❖ Bluetooth Socket(establishe RFCOMM channel to connect to a specific socket on other device and then transfers data from sides using Input Stream and Output Stream)
- ❖ To use the Bluetooth APIs, Bluetooth permissions – BLUETOOTH permission and BLUETOOTH_ADMIN permission are taken in manifest file [3].
- ❖ Both microcontroller and Bluetooth module are connected through serial (asynchronous) connection. the microcontroller’s digital pins Tx and Rx are connected to hc-05’s Rx and Tx respectively serial interface using 19200 bps baud rate. The external device sends a signal to find the presence of nearby Bluetooth devices which are on 10m range, and they respond with their address, then the external device selects HC-05 and synchronizes with that. A channel RFCOMM forms through which data transfers occurs. If connection is new then an authentication PIN is asked from the user, once entered the data can be sent/received using standard protocols.

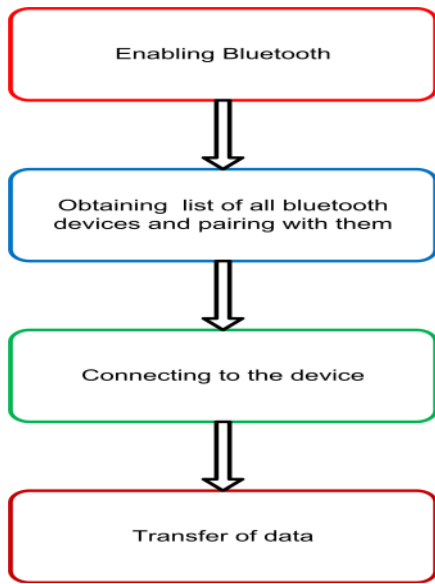


Fig. 5: Data transfer using Bluetooth protocol

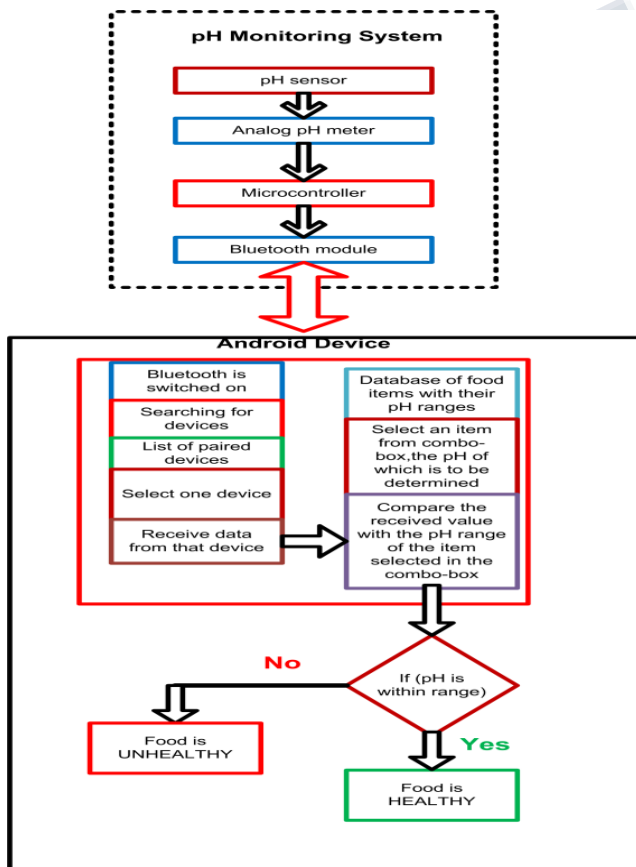


Fig. 6: The overall system

IV. RESULT AND DISCUSSION

To demonstrate the parameters of the item, its name, minimum pH, maximum pH are entered and a database is prepared. When the hardware is switched on and the sensor is kept in a food item, the pH value from the microcontroller is sent to the smart phone device through Bluetooth, the Bluetooth device(HC-05)is paired with the smart phone and the user will have to select it, after the pairing of both devices the value of pH will be displayed in the app and as the user selects an item from the spinner, the pH value is compared with the pH values of spinner item[6].After processing it will show that the pH is in range and the food is healthy to eat else not. In the following result the database is shown and the value received through Bluetooth is 5.5 which is for chicken, since it is in the range of its minimum and maximum pH so the message food is healthy will be shown, similarly with other item like “curd”, shown in following figures. Android application interface is used to obtain results-

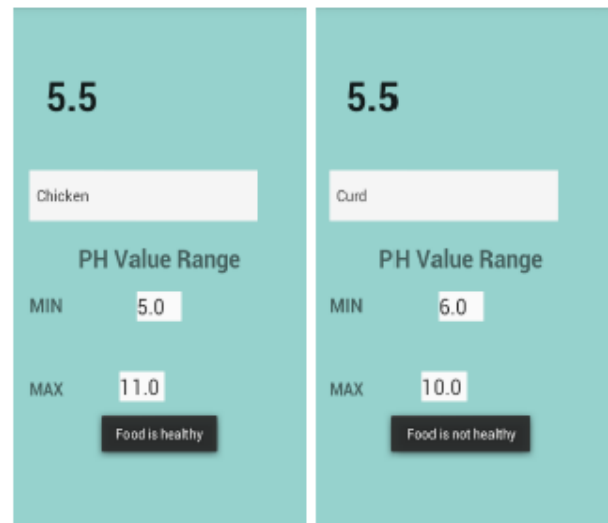


Fig. 7: The results showing database and comparison of value with database in android.

V. CONCLUSION

We have implemented an android based food spoilage detection system. This system process the data sent from the hardware in android and after being compared with already existing database, the message is displayed whether the food is healthy or not. This system can be used in the restaurants to prevent the customers from eating the spoiled food. Android Platform is used to develop this system and is successfully implemented and experimented. In future this system will be so much helpful. The hardware is installed in the place where the food is to be tested and the message whether the food is healthy or not is displayed on customer’s android phone through Bluetooth. This system can also work on Wi-Fi or other wireless techniques. It is a low-cost electronic system which

monitors the parameter of food item (sensed by different sensors) which are responsible for its spoiling can also be sent to smart phones [7]. This proposed system could help people from various diseases caused by consuming unhealthy food.

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