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Milk Density Analyzer Using AMR 7 Processor

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***Abstract*— Adulteration of milk is a common bane for the society. This paper aims to analysis the density of milk as well as its relative potential Hydrogen, ph. Based on the values of the percentage of milk present in a given sample, the sample is deemed to be pure or adulterated. This measure the supposed "whiteness" or purity of milk. A convenient graphical LCD display provides all the needful information about a given sample. Alternatively, there is also a provision for a PC interface.**
Keywords- LDR, ARM 7 processors, Testing box, Milk

I. INTRODUCTION.

A. Adulteration

It is sad to note that most Indians are resigned to drinking milk diluted with water which not only reduces the nutritious value of the beverage but also poses risk to health. Delhi Chief Minister Sheila Dixit says: "We have a huge challenge before us. We need more laboratories to test milk. India being largely a vegetarian society relies on milk rather than meat for its nutritional needs."

A glass (250ml) of unadulterated whole milk will give around 146 kcals; 8gms of fat and protein with 257mg of calcium. Calcium and other vitamins and minerals in milk make it an important part of a healthful diet for people of all ages. The benefits of drinking milk include strengthening bones, improved cardiovascular and oral health and even relief from PMS

B. Adulterants used in Milk

Milk is most commonly diluted with water - this not only reduces its nutritional value, but contaminated water can also cause additional health problems. The other adulterants used are mainly starch, sodium hydroxide (caustic soda), sugar, urea, hydrated lime, sodium carbonate, formalin, and ammonium sulphate.

The Indian Council of Medical Research has reported that "milk adulterants have hazardous health effects. The detergent in milk can cause food poisoning and other gastrointestinal complications. Its high alkaline level can also damage body tissue and destroy proteins. Other synthetic components can cause impairments, heart problems, cancer or even death. While the immediate effect of drinking milk adulterated with urea, caustic soda and formalin is gastroenteritis, the long-term effects are far more serious." Urea can lead to vomiting, nausea and gastritis. Urea is particularly harmful for the kidneys, and caustic soda can be dangerous for people suffering from hypertension and heart ailments.

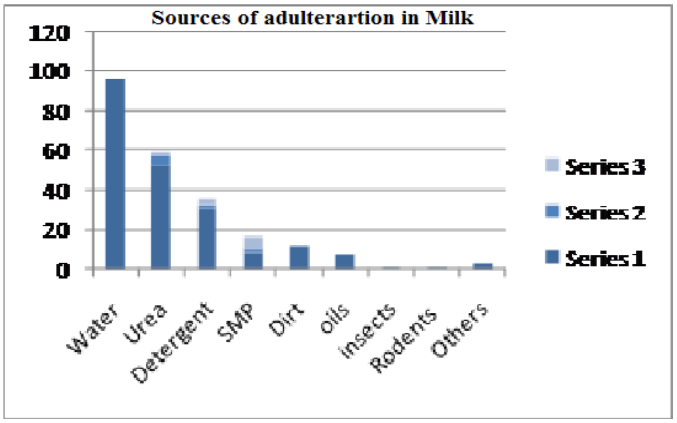

Figure 1.Different source of Adulterations used in Milk

Formalin can cause more severe damage to the body like liver damage. The health impact of drinking milk adulterated with these chemicals is worse for children. Caustic soda harms the mucosa of the food pipe, especially in kids. The chemical which contains sodium, can act as slow poison for those suffering from hypertension and heart ailments. The growing demand for rapid and easy measurement of monitoring food products has necessitated the use of sensors which have speed, sensitivity and stability over the conventional measurement technologies.

Milk is a common health drink consumed by people of all age groups. A large population in our country depends on milk from local suppliers. High water activity, moderate pH (6.4-6.8) and ample supply of nutrients make milk an excellent medium for method uses the principle of light detection; in which a testing box, encasing an LDR and a light source, is used to microbial growth. This demands high standards of hygiene in its production and distribution.

C .Testing for Hygiene using Visibility in Milk

During the milking and handling of the milk all kinds of dirt can get into the milk, such as straw, dust, hairs, flies etc. By filtering a representative sample of the milk through a white disc (The Sediment Test) these dirt particles become visible.

This test gives a very good indication of the cleanliness of the milk with respect to visible dirt. The test is also useful when training farmers in clean milk production and can also be used for the classification of milk (milk payment). It is obvious that a high amount of visible dirt also indicates high bacteria content.

In the section II we will cover the general block diagram along with important components used , section III deals with LDR and its working section IV we will focus on ARM & processor along with procedure to conduct this experiment in the last section we will see the results and conclusion respectively.

II. General Block Diagram

A. Objectives

We have light source to be zero candle bulb which is fixed on top of glass beaker in which testing sample Present, at the bottom on the beaker we place a LDR which will estimate the light it gets after its passed through the milk lesser the pure milk more the light if the sample contains pure milk lesser the light detected the LDR.

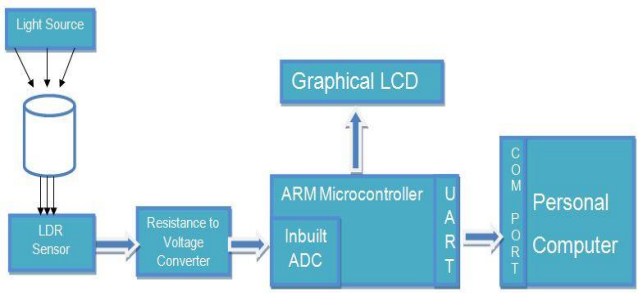

Fig.1 Block Diagram

III. LIGHT DEPENDENT RESISTOR

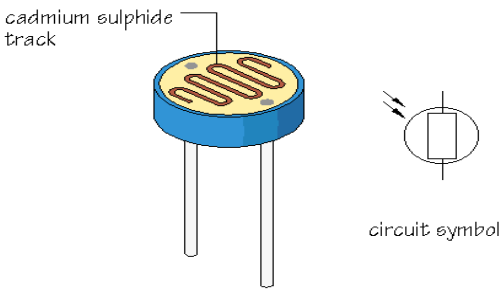

Fig.2 Schematic Diagram of a LDR

B.Working

Light-dependent resistor alternatively called an LDR, photo resistor, photoconductor, or *photocell*, is a variable resistor whose value decreases with increasing incident light intensity.

An LDR is made of a high-resistance semiconductor. If light falling on the device is of high enough frequency, photons absorbed by the semiconductor give bound electrons enough energy to jump into the conduction band. The resulting free electron (and its hole partner) conduct electricity, thereby lowering resistance.

A photoelectric device can be either intrinsic or extrinsic. In intrinsic devices, the only available electrons are in the valence band, and hence the photon must have enough energy to excite the electron across the entire band gap. Extrinsic devices have impurities added, which have a ground state energy closer to the conduction band - since the electrons don't have as far to jump, lower energy photons (i.e. longer wavelengths and lower frequencies) are sufficient to trigger the device.

Two of its earliest applications were as part of smoke and fire detection systems and camera light meters. Because cadmium sulphide cells are inexpensive and widely available, LDRs are still used in electronic devices that need light detection capability, such as security alarms, street light controller.

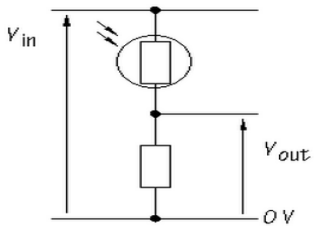

Fig.3 LDR at top

When light shines onto the LDR its resistance falls and current flows into the base of the first transistor and then the second transistor, Then LED lights.

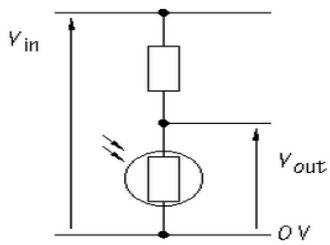

Fig.4 LDR at bottom

When the light level is low the resistance of the LDR is high. This prevents current from flowing to the base of the transistors. Consequently the LED does not light. [3]

IV. *ARM 7 MICROCONTROLLERS (LPC2101/2102/2103)*

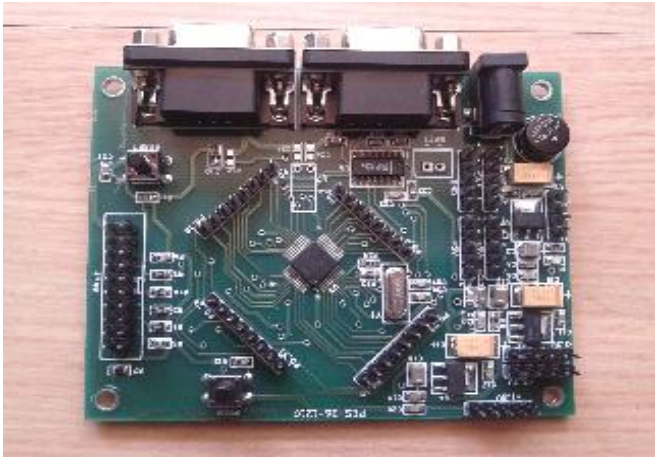

Fig.5 ARM 7 Processor

A. General description

The LPC2101/2102/2103 microcontrollers are based on a 16-bit/32-bit ARM7TDMI-S CPU with real-time emulation that combines the microcontroller with 8 kB, 16 kB or 32 kB of embedded high-speed flash memory. A 128-bit wide memory interface and unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical performance in interrupt service routines and DSP algorithms, this increases performance up to 30 % over Thumb mode. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty. [2]

B.Features

- 16-bit/32-bitARM7TDMI-S microcontroller in a tiny LQFP48 package.
- 2 kB/4 kB/8 kB of on-chip static RAM and 8 kB/16 kB/32 kB of on-chip flash program memory. 128-bit wide interface/accelerator enables high-speed 70 MHz operation.
- ISP/IAP via on-chip boot loader software. Single flash sector or full chip erase in 100ms and programming of 256 bytes in 1ms.
- Embedded ICE RT offers real-time debugging with the on-chip Real Monitor software.
- The 10-bit A/D converter provides eight analog inputs, with conversion times as low as 2.44ms per channel and dedicated result registers to minimize interrupt overhead.
- Two 32-bit timers/external event counters with combined seven capture and seven compare channels.
- Two 16-bit timers/external event counters with combined three capture and seven compare channels.[2]

V. Procedure to Find Contamination of Water in Milk

A. Hardware Initialization and Mounting:

1. First a 10X8 cm wooden box is constructed and covered with black tape to prevent entry of external light.
2. LDR mounting is done at the exact center of the box. Simultaneously a zero candle bulb is placed exactly perpendicular to the LDR.
3. On a separate board, the ARM controller and the display unit are mounted.
4. Connections between the controller, display and control pot are done as mentioned in the pin configuration previously.

B. To measure milk density:

1. Initially, switch on the bulb to measure initial value of the LDR.
2. Place an empty glass beaker and determine the voltage reading.
3. Use the above two readings as initial values.
4. Repeat step 2 by filling the beaker with water and milk subsequently.
5. Now take the adulterated sample to determine its relative purity (density). The adulterated sample at this point is assumed to only contain water at this stage.
6. The respective voltage reading as well as the percentage is displayed on the GLCD.

   The results that are displayed on the GLCD can be interfaced to a PC using the serial communication port. A serial to USB converter however is required as certain current generation PC's do not have serial port. The interface dialog is created in MS Visual Basic 2008 and is shown in the next slide.

VI. Results

The table:-1 shows the different sample being measured and the respective voltage reading for the measurement in the milli volt, for the direct light default voltage is read as 450mV these readings are with respect to the environment we are conducting our experiment and may vary with different lighting environment. Black box is used here to obtain constant lighting environment.

To measure milk density:

1. Initially, switch on the bulb to measure initial value of the LDR.
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4. Repeat step 2 by filling the beaker with water and milk subsequently.
5. Now take the adulterated sample to determine its relative purity
6. (Density). The adulterated sample at this point is assumed to only contain water at this stage.
7. The respective voltage reading as well as the percentage is displayed on the GLCD.

Description	Voltage Reading(mV)
Direct Light	450
Empty Beaker	350
Beaker Containing Water	300-350
Beaker Containing Milk	1900-2100
Beaker Containing 30ml milk+10ml water	1700-1800
Beaker Containing 20ml milk+20ml water	1500-1600
Beaker Containing 10ml milk+30ml water	1300-1400

Table .1 Different reading with different sample values

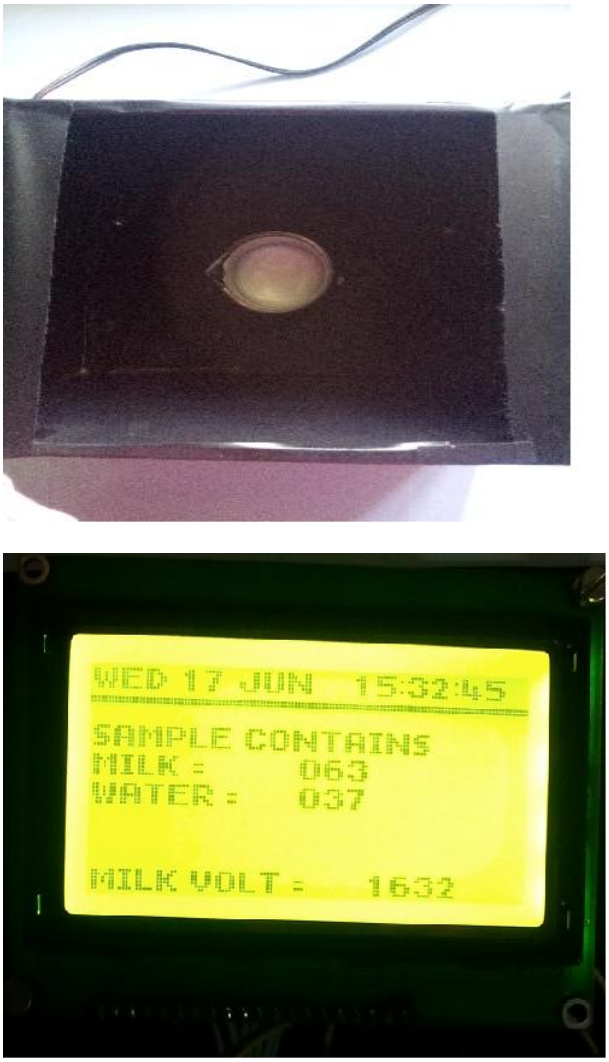

Fig.6 Box with Milk sample being tested

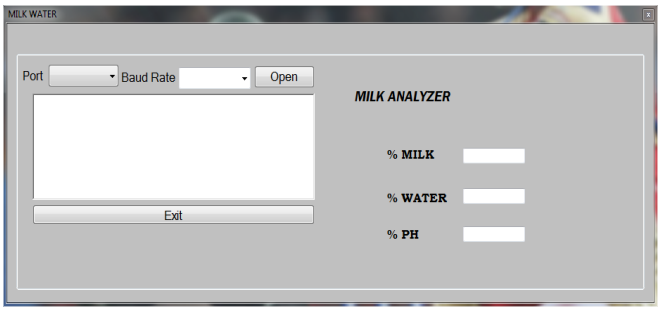

Fig.7 PC interface Dialog box screen shot

VII. Conclusion

The value of the density of milk is obtained with help of this technique and it is found to 85% accurate and result are displayed on the LCD screen. The following conclusions can be drawn from the results:

1. A decrease in the voltage reading of the milk sample caused by an increase in LDR resistance clearly points to adulteration in milk.
2. The adulterant is then identified as water, as the voltage readings obtained for different values of water mixed clearly point to more light penetration i.e. a decrease in the voltage
3. pH value of Milk is around the range of pH 7.0. This confirms that milk is neither acidic nor basic.

XI. Reference

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Authors Profile

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