Detection of Fat in Milk Using Photoconductivity and Color Detection Tecnique with Smart Billing

Vasudha V. Ayyannawar and Soumya R. Metri

Abstract Agriculture is a major part of India, and dairy bussiness is combined profit for the Indian business or the economy. Farmers supply their milk to the dairies and get the payment based on the purity of milk that they add per liters. As we know, nowadays, world has become more faster with trending requirements, and needs are fulfilled with more luxurious lifestyle adoption by the people; therefore, it is necessary to improve the present lifestyle of Indian farming and dairy management system. The various factors are like fat, classification of cow milk or buffalo milk, and generating the desired rate for the amount of fat calculated in the milk. So, the system calculates these parameters, and simultaneously the payment is done automatically. The system has two major part of module; one is kept at milk storage center, and the other is at billing counter. The microcontroller reads the data & sends it to the Android phone. Using Blynk application installed in the phone, the calculation of bill can be made for calculating daily payment. The system helps to detect the fat content in the milk and provide smart mobile application. The sensors are coherenced with the Arduino board and microcontroller. Cost of the system is also low to detect fatness in the milk sample. Using the Internet of Things (IOT) process, the industry can take the real-time readings of milk and rate to the government which helps to stop the illegal things happening nowadays and getting fair price to the farmers

Keywords Milk storage center (MSC) · Blynk · Arduino board · Microcontroller · IOT

1 Introduction

Depending upon the time and situation, there is a need to change the working system of the old modules like dairy farming or it may be agriculture. Firstly, it is required to calculate the amount of fat present in milk. Manual testing of fat and quantity is

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time-consuming. Secondly, some dairies in villages do not have good milk testing equipments. In such condition, the milk sample can be tested, once the milk is free from fat which can take one to two hours. By that time, the milk packed in a plastic bags or bottles is unhealthy. Another reason is that since the process is done manually it can result to mistakes which is biggest loss to farmers. Therefore, to decrease the manual work and to get better result, there is a need to replace the existing system with a new system using the system where milk sample can be measured automatically and in low cost. As a result, huge no. of farmers are supplying their milk to the dairy. It is a responsibility of the dairies to get the quality of milk from each farmer and give fare amount to the farmers.

2 Related Work

To measure the fat content, the principle used is a optical scattering of light on the homogenized milk. To overcome the problems of present method of milk analyzing, here is the system that had spot calculation of fat present in milk. The fat is calculated by the light that is passed and scattered in the milk sample that is considered as a percent of fat in the milk. Sensor is a device that helps to classify the cow milk or buffalo milk and provides a corresponding output.

2.1 Fat Measurement

2.1.1 Gerber Method

In this method, the removal of fat is done by adding of sulfuric acid, and the fat present is seen directly on calibrated butyrometer. The fat is removed from the milk by centrifugal force, the reason to use sulfuric acid is to dissolve protein that comes around, and amyl alcohol is added to increase the fat separation.

Procedure

(1) Take 10 ml of acid in a pipette and add 10 ml of sulfuric acid into butyrometer. (2) Then, add 10.75 ml to the pipette and send the sample into butyrometer. (3) By using 1 ml pipette, add 1 ml of amyl alcohol and let it close and shake it well until no white bubbles or particles are seen. (4) Keep the butyrometer in a water for 5 to 10 min. (5) Now remove it and clean it with a dry napkin, and now place the two butyrometer opposite for 6 min. (6) Then, make it cool for 10 min. (7) Finally, the fat is left at a lower end of the pipette.

Fig. 1 Gerber method

2.1.2 CLR Method

This method states the law of floating solid object on a liquid when it is added in a milk. Therefore, in this method, the procedure is as follows: Add 70 ml of milk in a pipette and dip a lactometer into it, scale mark on the milk is displayed, and simultaneously, these readings are noted down in a farmer card or a book (Fig. 1).

3 Approach

Keeping in mind about the disadvantages of existing method of analyzing milk which is spoken previously, "detection of fat in milk using photoconductivity and color detection technique" is designed in such a way that its construction is easy and also familiar to operate.

Figure 2 shows block diagram of milk storage, and a list is shown below:

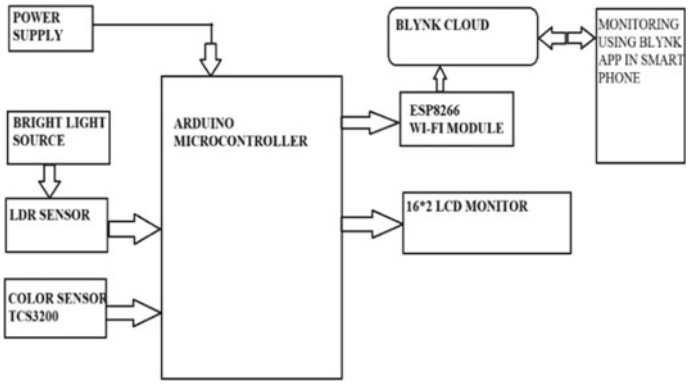


Fig. 2 Block diagram of entire module

- Aurdino microcontroller
- LCD display
- ESP-8266 Wi-Fi module
- Color sensor TCS3200
- LDR sensor
- Blynk cloud
  - Sensor block: The sensor used for detection of milk fat is LDR, and to distinguish between cow's milk and buffalo's milk, we use color sensor TCS3200.
  - Microcontroller: The role of microcontroller is to store the readings and by the mean time calculate the bill as well and display it on LCD screen. The microcontroller used here is ATMEGA 328.
  - LCD display: LCD is interfaced with microcontroller to show the readings of fat and rate per liter.
  - ESP-8266: This module is connected to Wi-Fi network to update the data in cloud.
  - Updated data is put on Blynk cloud and later controlled and monitored using a smart phone via a mobile application called 'Blynk'.

3.1 Working of Proposed System

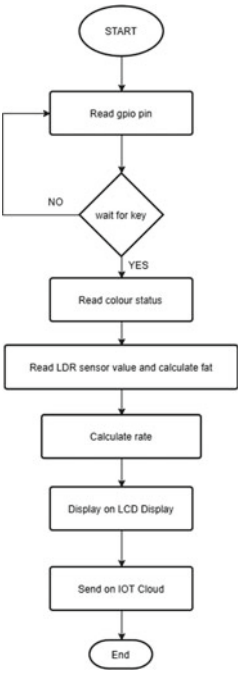
Milk tester is a method, which gives the result, that is, fat, based on the light scattered by the milk. A device called photoresistor whose resistance decreases when the incident light gets increases. It is a semiconductor material having high resistance.

It works on the principle of photoconductivity. When the light is fallen, the more number of electrons are released, which leads to increase in charge carrier those are holes. Thus, the results can be analyzed by the change caused in resistance, that is fat content in milk is shown.

For buffalo's milk, the fat present is 6–7%, and for cow milk it is 3–4%; if we do not get a fat in a range, the milk can be given with very low cost with no profit to the farmers.

Color sensor TCS3200 module is designed and used to detect whether the milk sample given under test is buffalo or cow's milk, by checking its color intensity, as we all know that cow's milk is slightly yellowish in color, whereas buffalo's milk is pure white. Based on this technique, we can easily identify whether it is cow's milk or buffalo's. Finally, the obtained data are displayed on LCD monitor and updated on Blynk cloud IOT platform, where data can be monitored through Internet itself.

3.2 Flowchart



3.3 Pin Configurations

ARDUINO UNO

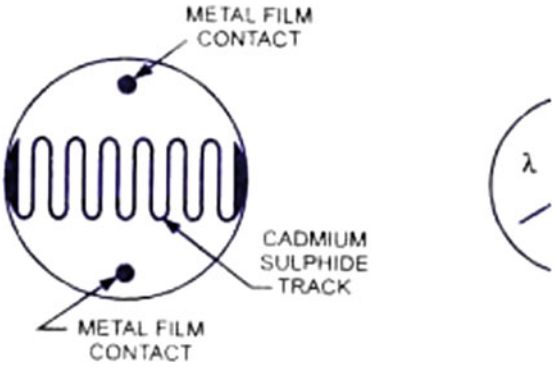
- MCU: Atmega 328
- Input voltage: 7–12 V
- Operating voltage: 5 V
- SRAM: 2 KB
- EPROM: 1 KB

3.4 Units

Arduino Uno board has two microcontrollers, ATMega 16 and ATMega 328. ATMega 16 has built-in RC phase oscillator with 2–8 MHz frequency, and it can generate its own oscillation. However, ATMega 328 is a open-source, hardware-abstracted, and inexpensive physical computing platform. It has built-in 32 K memory. The major components are USB connector, power port, microcontroller, analog input pin, digital pin, reset switch, crystal oscillator, and USB interface chip. It has 14 digital input–output pins in which six can be used as PWM outputs and six analog input pins.

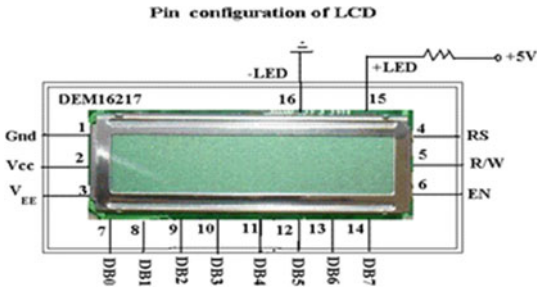
LDR Sensor

It is also known as photoresistor, it is a light-sensitive device, and they are made up of semiconductor having high resistance. When light falls that is when photons fall on device, the electrons in the valence bond of the semiconductor materials are excited to conduction band.



Working LDR is made up of most commonly cadmium sulfide. The zig-zag pattern shown helps in obtaining or getting accurate resistance. The zig-zag like area seperates the metal into two regions, the Ohmic contacts are done on both sides. Important to note is that this ohmic contact should be less as possible, so that resistance should get changed only based on the effect of light only. LDR needs only small power and voltage. Cadmium sulfide and binding materials are mixed, pressed, and sintered.

LCD Display(16*2)



Together millions of pixels has made a single display, combining of three sub-pixels that is red, blue, and green which form a single pixel. It is a mixture of two states of solid and liquid. LCD display are used in TVs, laptops, and cell phones. It is used to display the image. LCD is made with active display grid or it may be made up with passive display. The consumption of power is low that is the advantage of LCD.

Introduction to Blynk–IOT Plarform

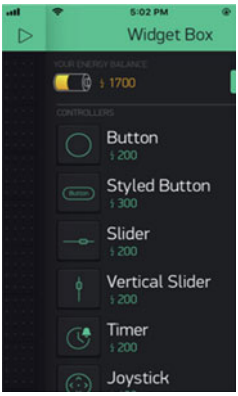
Blynk is designed for Internet of Things. Blynk can control or maintain the hardware device remotely. It can display sensor data, it can read data, it can store data, and it can visualize sensor data.

Blynk has the following three major components:

Blynk App: It helps to do good interfacing in our project with the help of widgets.

Blynk Server: It helps different communication between Android phone and the hardware. It is a open source which handles hundreds of devices. It provides secure cloud communication as well.

Blynk Library: With Blynk library, you can connect **over 400 hardware models** to the Blynk cloud. There are huge set of libraries which supports the blynk application.



4 Results and Analysis

See Figures 3, 4, 5, 6, 7, 8, 9, 10, and 11.

Fig. 3 LCD display screen

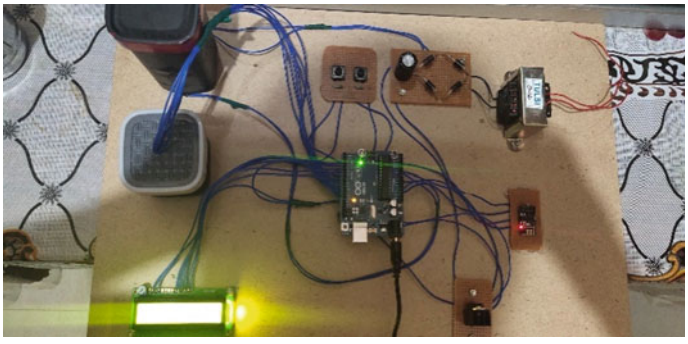


Fig. 4 Complete hardware

Fig. 5 Fat content in the milk

Fig. 6 Rate to be given for the milk

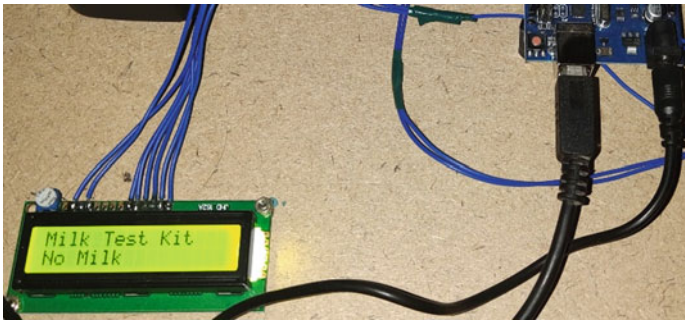


Fig. 7 When its completely water

5 Conclusion

In this paper, the system provides the ability to justify the quality of milk. The exact values of fat are displayed on LCD, simultaneously these values are sent over

Fig. 8 When its cow milk

Fig. 9 Fat content in the cow milk

the Internet, and anybody can retrieve the values over the Internet. Thus, with this accurate values, the farmers would get proper sale value of milk. The technology implanted in this system will definitely improve the system by giving fair price to farmers and also will minimize the corruption in the delivery system.

Fig. 10 Smart billing

Fig. 11 Rate and fat content display in a smart phone

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