MILK QUALITY ANALYSIS AND INVOICING SYSTEM USING SMART TECHNOLOGY

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Abstract

India's economy benefits from the dairy industry because it plays such a significant role in the country's economy. Dairy products need milk from farmers, who are compensated based on the calibre of the milk. It is well known that individuals that lead wealthier lives are better able to keep up with trends and consumer needs due to the world's fast development. As a result, India's agricultural way of life has to be improved. Measurements are made of milk's fat content, pH, and appropriate fat mass ratio. The system calculates these parameters, and the microcontroller reads the data before sending it to the Android phone.
With the Blynk app on a phone, daily payments and billing calculations may be made. This device includes a clever mobile application that may be used to help determine the milk's fat level. Microcontrollers and Arduino boards both can use the sensor. The technique for identifying fat in milk samples is quite affordable. Using the Internet of Things (IoT) technology, the sector compensates farmers properly and gives Real-time dairy value for governments and proportions. The system is enhanced by the presence of humidity and gas sensors.

Keywords: pH sensor, LDR sensor, humidity sensor, gas sensor, microcontroller

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1. Introduction

Modify existing modules, such as dairy and agriculture, depending on the situation and the time. You must first ascertain the milk's fat content.(Saravanan et al., 2021) It takes time to manually verify the fat and amount (Gehlot et al., 2022). Second, a number of the dairy farms in the community lack the necessary analytical tools. Tests can verify whether the milk has been skimmed in certain circumstances (Kumar et al., n.d.). This might take as long as two hours. Plastic milk bottles and bags encourage bad behaviours. The manual nature of the process, which is prone to error, is another worry. most of which concentrate on conditions that cause heart failure.

This is the largest loss for farmers. The old system has to be replaced with a new one as a result. It uses technology to automatically and affordably measure milk samples in order to save labour costs and generate higher-quality findings. As a result, milk from several farms is used in dairy products. It is the duty of consumers of dairy products to evaluate the calibre of each farmer's milk and to pay the farmer fairly. Users will be able to learn more about milk using moisture and gas sensors. This system, which makes use of the Arduino controller to sensor several properties of milk, was developed.(Zakeri et al., 2019)

Examples of parameters include a gas sensor, humidity sensor, pH sensor, and LDR. The sensor is connected to the Arduino controller. The software that has been created allows parameters to be presented and spoken out on the LCD panel.(Zakeri, 2019) This is a reliable and affordable method of determining adult milk. Additionally, in order to address unlawful issues like milk quality during milk production, the dairy business may utilise the IOT approach to submit information about milk in real time to the government.(Kumar et al., n.d.)

2. Literature Review

Recently, generals' concern over the chemical concoction that diminishes the benefits that pure milk offers has intensified. Also, it is quite challenging for the ministry of food to verify that producers of milk and products related to it follow the national code in the modern world. Moreover, nutrition and hygiene are two of the major challenges facing nutrition science. In order to guarantee that recognised criteria, standards, and controls are implemented to milk and milk products, milk quality control is thus the use of approved tests.(Tsenkova et al., 1992) The tests are designed to verify that milk products meet recognised requirements for purity and chemical composition. Thus, it requires money to guarantee that milk and milk products are of a high quality and to ensure that producers, processors, and marketing organisations follow the approved rules of conduct.(Cantàfora et al., 2007)

3. Proposed design methodology

The milk tester technique evaluates whether something is fat depending on the light that the milk scatters. a "photo resistor," whose resistance decreases as the strength of the incoming light increases.(Goswami & Dangi, 2021) It is an incredibly durable semiconductor material. It operates according to the photo conductivity hypothesis. More electrons are released when the light fades, increasing the number of charge carriers known as holes. Consequently, the change in resistance brought on by the milk's fat content allows for an examination of the data. To determine if the milk that has been delivered is safe, the PH module is employed. Milk characteristics are measured using a gas sensor, while humidity information is provided using a humidity sensor. After being gathered, the data are updated on the Blynk cloud IOT platform and shown on LCD panels, enabling online data monitoring.(Elgerbi et al., 2004) Several factors, including FAT and whether the milk is considered to be cow or buffalo milk, provide the required rate for the anticipated amount of fat in the milk. The system therefore establishes these settings. The microcontroller is responsible for reading the data and transmitting it to the Android phone. With an IOT application that is installed on a phone, the cost of milk per litre may be estimated for payment.(Chakraborty, 2020) The technology assists in determining the milk's pH, humidity, gas content, and fat level while also offering a smart mobile application and LCD display.

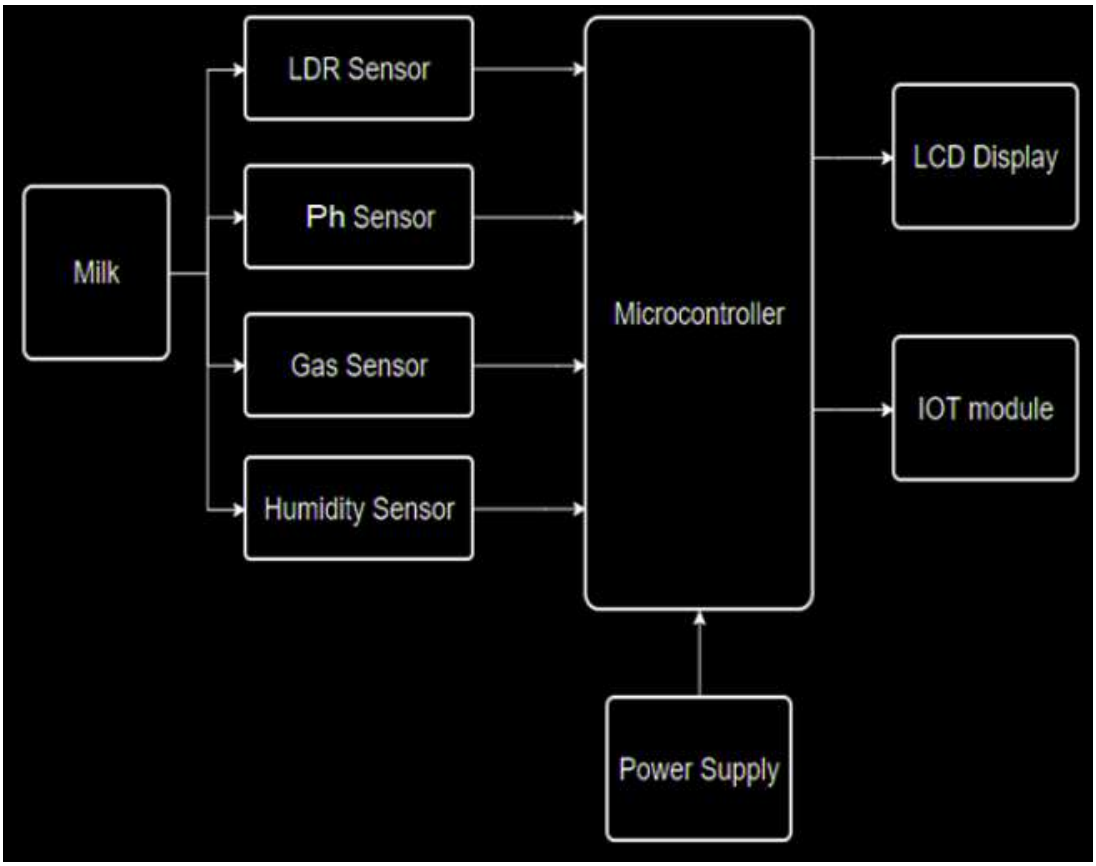

Figure 1: Block Diagram

3.1 Problem statements

- Why Adding several chemicals to the current process will have a negative impact on health.
- In order to check the milk quality, labour is needed.
- The procedure of evaluating the milk is time-consuming.
- The potential for mistake in manual processes.
- The current system has no records and no remote monitoring system.

3.2 Research Objectives

The major goal of this initiative is described below.

- Locate the milk's fat.
- To assess the level of any dangerous gases.
- To determine the milk's PH level.
- Employing a humidity sensor to check the milk's refrigerated level.
- The use of IOT to enable remote monitoring.
- Create an algorithm that can estimate milk's cost depending on its fat content.

3.3 The way that sensor modules work

(i) LDR Sensor:

The operation of this resistor is based on the photo conductivity hypothesis. It simply implies that the conductivity of the material reduces when light strikes the object's surface and that electrons in the object's valence band are stimulated to move to the conduction band. These photons in the incoming light must have an energy greater than the band gap of the semiconductor material. As a result, the electron in the valence band is compelled to go into the conduction band.(Palmquist et al., 1993)

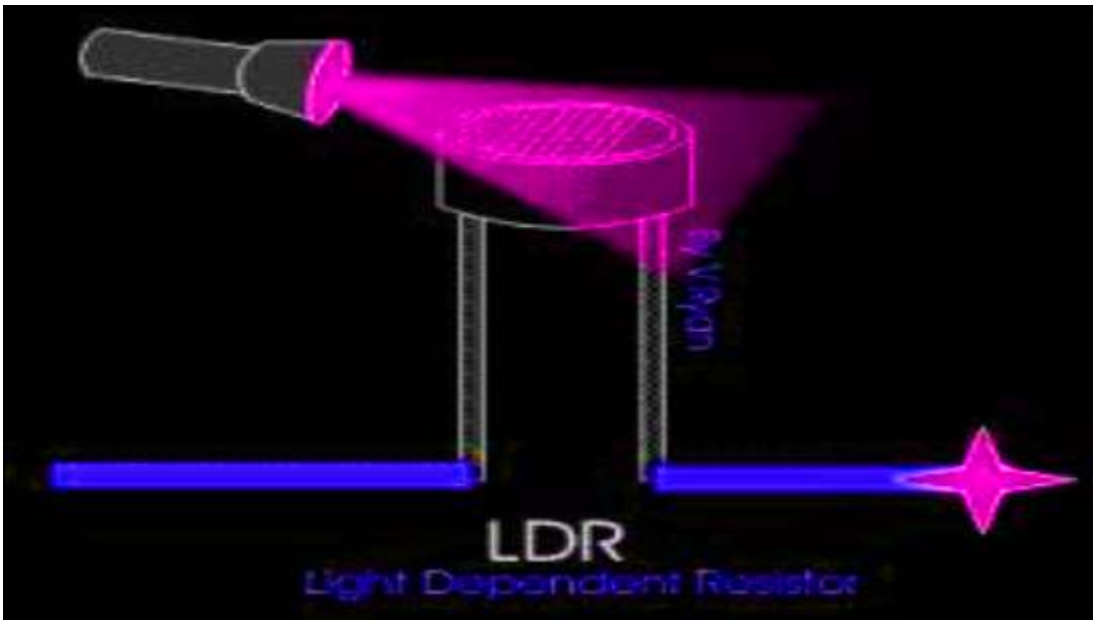

Figure 2: LDR Sensor

The resistance of these devices varies when light touches them; in the dark, it rises. When kept in a dark environment, an LDR has a high resistance, and when kept in a light environment, it has a lesser resistance.

(i) pH Sensor:

The concentration of hydrogen ions in a liquid solution is measured using the pH scale, which is a very important tool in many liquid chemical processes (industrial, pharmaceutical, manufacturing, food processing, etc.). The phrases "acid" and "caustic" are used to characterise distinct sorts of solutions, depending on their pH. The pH scale, which rates acidity on a range of 0 to 14, with 7 (clean water), indicating neutrality, is used to quantify acidity.

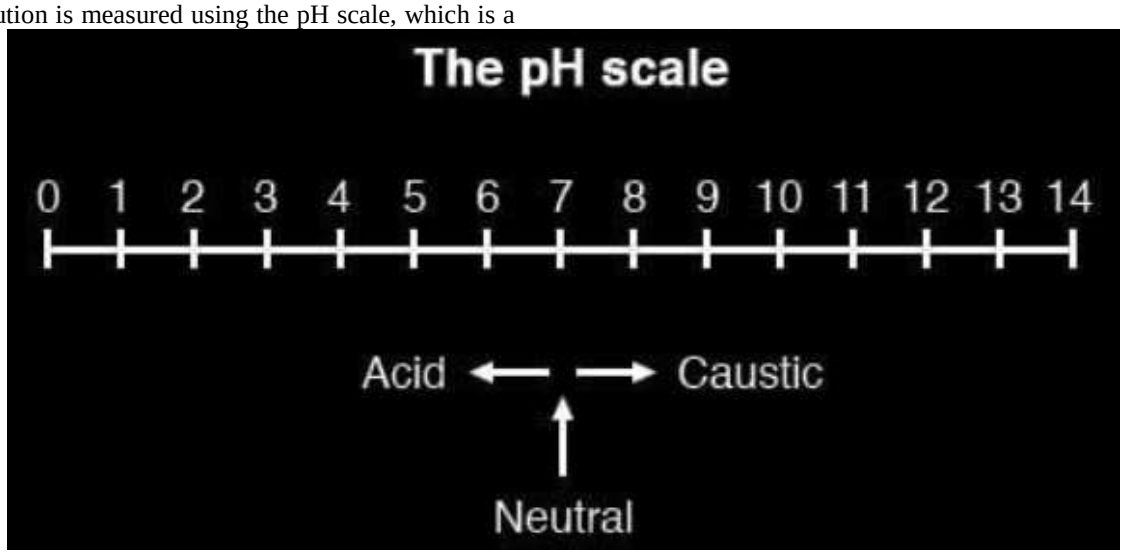

Figure 3: PH Value

Lowercase "p" in pH stands for the negative common (base 10) logarithm, whereas uppercase "H" in pH stands for the element hydrogen. Hence, pH is used to calculate the number of hydrogen ions (H+) present per litre of solution on a logarithmic scale. It's interesting to note that the "p" prefix is also used for various chemical measurements that call for a logarithmic scale; two examples are pCO2 (Carbon Dioxide) and pO_2 (Oxygen).

Figure 4: Experimental Setup

The experimental setup for milk quality analysis with billing system is shown in the above diagram. Now, exhibiting the PH Value and the Fat Sensor on the LCD Display marks 50% of the project's completion. The term LCD refers to a liquid crystal display. It is a particular kind of electronic display module that is used in a variety of gadgets and circuits, such as TVs, computers, calculators, mobile phones, and other electronic devices. The two main uses for these displays are seven segments and multi-segment light-emitting diodes. Adopting this module has several major benefits, including low cost, simple programming, animations, and the absence of any limitations on the display of bespoke characters, unusual and even animations, etc. Two of the 16 by 2 LCD's registers are the data register and the command register. Switching between registers is the primary function of the RS (register select). When the register set is set to "0," it is referred to as a command register. A register set of 1 is referred to as a data register, which is similar to this.

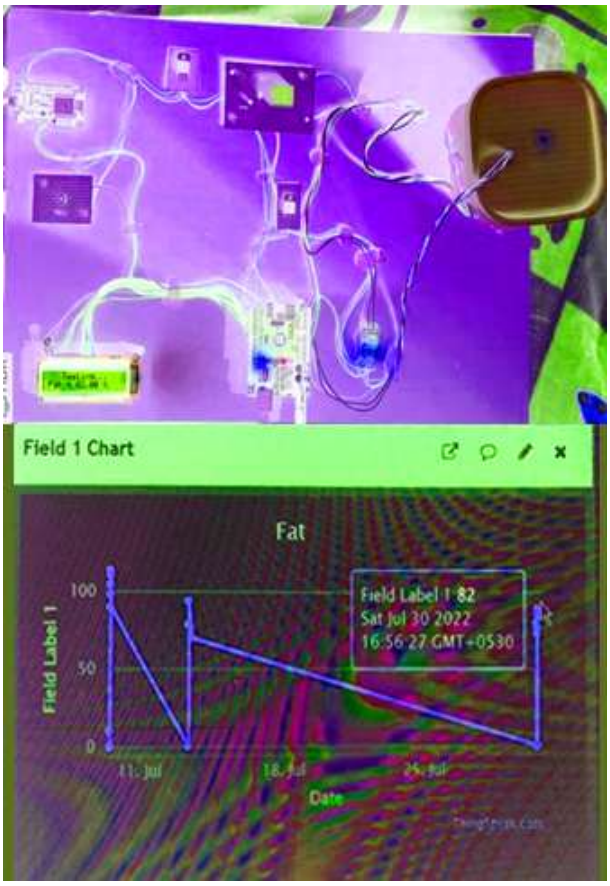

Figure 4.1: FAT Sensor Results

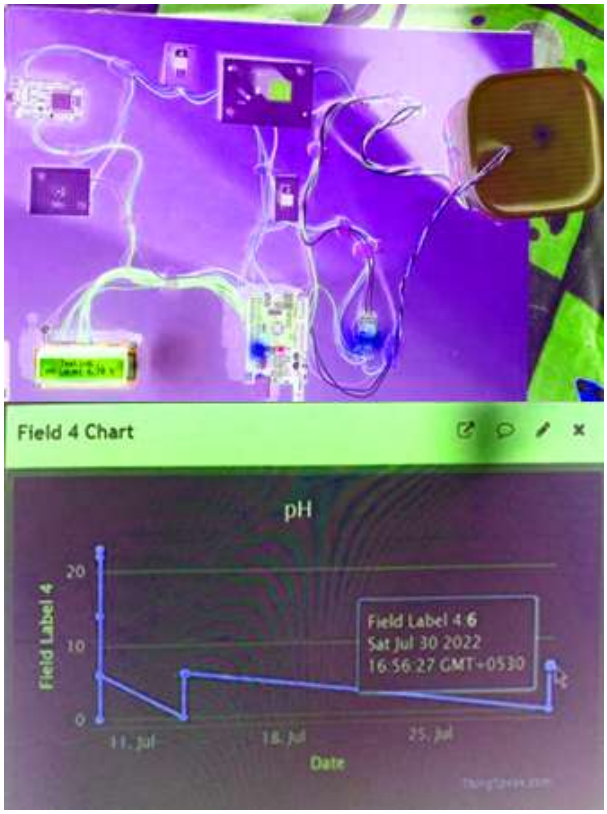

Figure 4.2: pH Sensor Results

4. Conclusion

Examining all of the aforementioned systems will reveal the study's main objective, which is to locate the fat. The MQ135 gas sensor reliably detects dangerous gases including ammonia, hydrogen sulphide, benzene series steam, smoke, and others. Calculations for amount per litter, IOT cloud for remote monitoring, and milk humidity are also used. A pure milk's pH ranges from 6.7 to 6.9 (Zakeri et al., 2018). It is influenced by the diet, lactation period, and breed of the cow, among other factors. The fat content of some animals ranges from 3.0 to 4.0 (Rath, 2019). Buffalo milk has a 7-8% fat concentration compared to cow milk's 6 percent fat level. Cadmium sulphide is the component of LDR that is used most frequently. It doesn't take a lot of energy.

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