

AUTOMATIC MILK QUALITY ANALYSIS SYSTEM

Ms.L.Sarika, V.V.Sahithi, P.Vanitha Devi, Y.Anitha Vennela, S.K.Reshma, T.Gayatri harshitha

Professor, Electronics and Communication, GVPCEW, India
Student, Electronics and Communication, GVPCEW, India
Student, Electronics and Communication, GVPCEW, India
Student, Electronics and Communication, GVPCEW, India
Student, Electronics and Communication, GVPCEW, India
Student, Electronics and Communication, GVPCEW, India

ABSTRACT

The milk is the important nutrition for human being. The good quality milk should be free from the adulterants. Utilization of adulterated milk causes severe health problems and a great concern to the food industry. The Country milk producers and consumers facing problem to find the quality of milk, accept the fair of price and consumption. So, it is necessary to ensure the quality of milk by measuring the vital parameters present in the milk and the adulterants that are added to the milk. The different parameters of milk such as fat, temperature, pH can be measured using sensors. The IOT (Internet of Things) process contributes in providing the real time reading information of milk to the government by the milk industry. So that it helps to overcome the illegal things regarding milk quality during the production of milk packets. All the sensors are combined to form compact and flexible system which analyze and classify the quality of milk and display on LCD screen. Problem faced in small diaries and by the individuals can be prevented by detecting the quality of milk.

Keyword: *pH sensor, LDR sensor, humidity and temperature sensor, gas sensor, microcontroller.*

1. INTRODUCTION

Milk is a vital source of nutrition for human beings. It provides essential nutrients such as proteins, vitamins, and minerals necessary for growth, development, and overall well-being. The issue of milk adulteration is a pressing concern for both milk producers and consumers. Consumers face challenges in discerning the quality of milk they purchase. The presence of adulterants makes it difficult for consumers to make informed choices, leading to concerns about food safety and the reliability of milk products. Additionally, the fair pricing of milk becomes a contentious issue when adulteration practices artificially inflate the volume of milk while reducing its nutritional value. So, we choose automatic milk quality analysis as our project which helps in finding quality, fair price and the condition of milk.

2. BLOCK DIAGRAM

The block diagram of IOT based milk quality analyzer using AVR microcontroller is shown in the above figure. In this implemented system, milk adulteration is detected with the help of pH, gases, humidity, fat, temperature. To make the system IOT based there is a use of Wi-Fi module. Hence, it is possible to interface the system with android phone or PC. Consider different samples of milk which includes fresh milk which is processed as per the standards and milk which is contaminated by toxicity, which also includes milk which is preserved for long hours. Now the samples are accordingly monitored one after the other. In general, the test will be performed with reference to standard parameter values according to which any abnormalities found in the samples will be determining its quality. As specified earlier about the five modules involved, the working method of those is as follows.

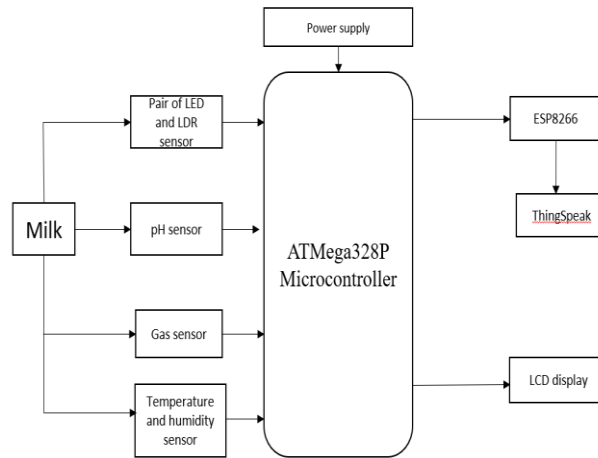


Fig -1 :Block Diagram of Milk Quality Analysis System

2.1 Temperature and Humidity Sensor

The DHT22 Temperature and Humidity Sensor is a versatile and cost-effective sensor used for measuring environmental temperature and humidity. Ensuring milk is stored at the correct temperature is essential for safety. The DHT22 sensor in a milk quality analyzer system monitors both temperature and humidity levels in the storage area. This helps prevent bacterial growth and spoilage by maintaining optimal conditions. If the temperature or humidity deviates from the recommended range, the system alerts users to take corrective action, ensuring the milk remains fresh and safe for consumption.

2.2 pH Sensor

Every liquid has its own pH value according to temperature and other dependent parameters. So the standard fresh milk has pH of range 6.5-6.7, above and below this range is totally considered as abnormalities in its quality. Here it monitors the pH and provides a visual alert via LCD, which displays the pH level and indicates whether the tested milk is normal or abnormal, in simple words good quality or bad quality.

2.3 Gas Sensor

The gas sensor in the milk quality analyzer detects harmful gases like ammonia or nitrogen oxides, which could indicate contamination. It ensures that the milk is free from pollutants that could compromise its safety. Any abnormal gas levels are identified to prevent consumption of tainted milk, safeguarding consumer health. By monitoring gas levels, the system helps maintain milk quality and ensures it meets safety standards.

2.4 LED-LDR Pair

LED-LDR pair is used for fat measurement in milk. Light emitted by the LED passes through the milk, and as it travels, fat particles absorb some of this light. This absorption affects the intensity of light reaching the Light Dependent Resistor (LDR), causing its resistance to change. By measuring this change in resistance, the system can estimate the fat content in the milk sample. Essentially, more fat present, the more light it absorbs, leading to a noticeable change in resistance.

CONNECTION DISCRIPTION:

The connection diagram depicts an IoT-based milk quality analyzer employing an AVR microcontroller. Key components include the power supply, ATMEGA 328 microcontroller, and various sensors such as pH, gas, temperature, humidity, and LED-LDR pair. All sensors are linked to the microcontroller, while LCD module data pins are connected for display purposes. The pH sensor assesses milk acidity, the LED-LDR pair measures fat content, and the temperature sensor monitors storage temperature. Additionally, the humidity sensor maintains optimal moisture levels to prevent spoilage. All sensors operate on a 5-volt DC supply and are connected via VCC, output, and ground pins to the microcontroller, with output data displayed on the LCD screen.

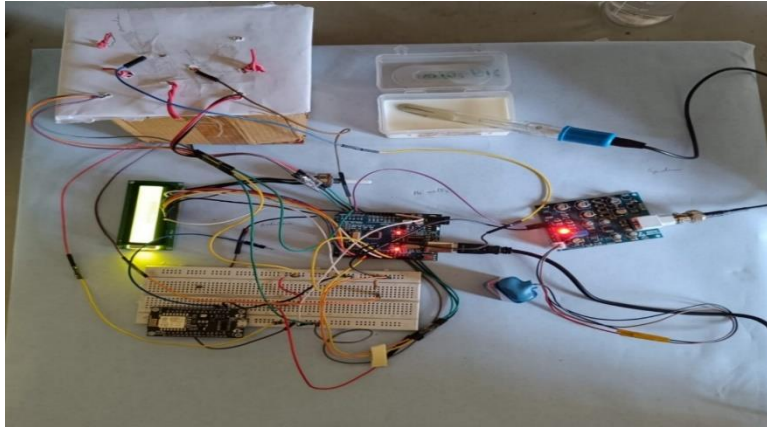


Fig -2: Connections of Milk Quality Analysis System

3. Flow Chart

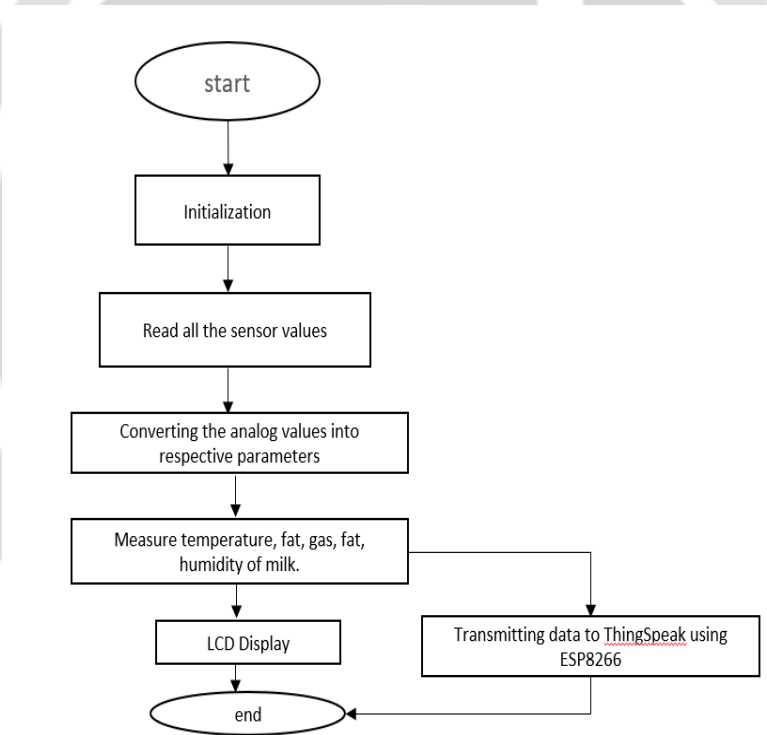


Fig -3:Flow Chart of Milk Quality Analysis System

The milk analysis system is connection sensors like gas, pH, temperature, LDR, and an LCD display to your Arduino board. Then, set up communication with ThingSpeak by making an account and defining fields for sensor data. Write code to read sensor data continuously and display it on the LCD screen. Implement code to send this data to ThingSpeak for ongoing monitoring. Lastly, place all these processes in a loop to ensure continuous operation, enabling real-time monitoring of milk quality. With careful setup and error handling, you'll have an effective system for quality control.

4. Results



Fig -4: Temperature & Humidity of milk.



Fig -5: Gas percentage of milk.



Fig -6: pH of milk.



Fig -7: Fat percentage of milk.

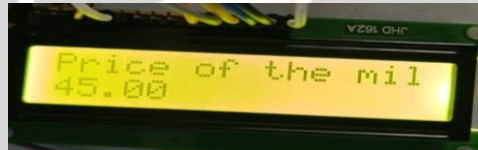


Fig -8: Litre price of milk



Fig -9: Quality of the milk

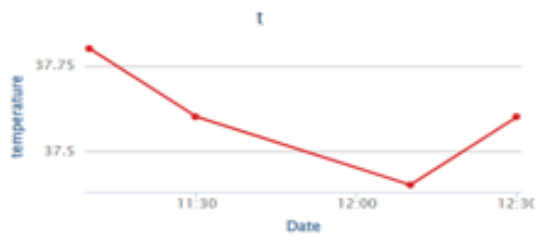
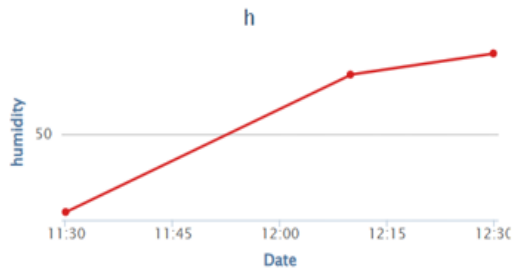


Chart -1: Temperature graph of Milk



**Chart -2: Humidity graph of Milk
milk parameters**



Chart -3: Gas Percentage graph of Milk

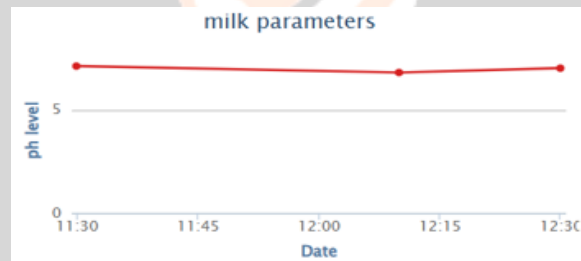


Chart -4: pH level graph of Milk



Chart -5: Fat Percentage graph of Milk

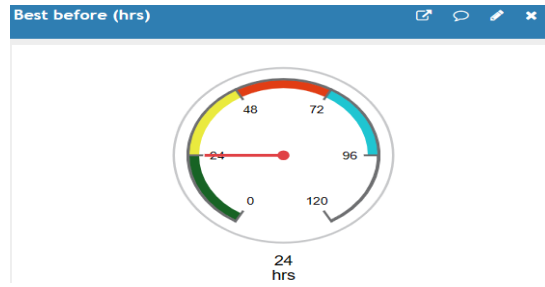


Chart -6: Storage of tested milk (in hours)

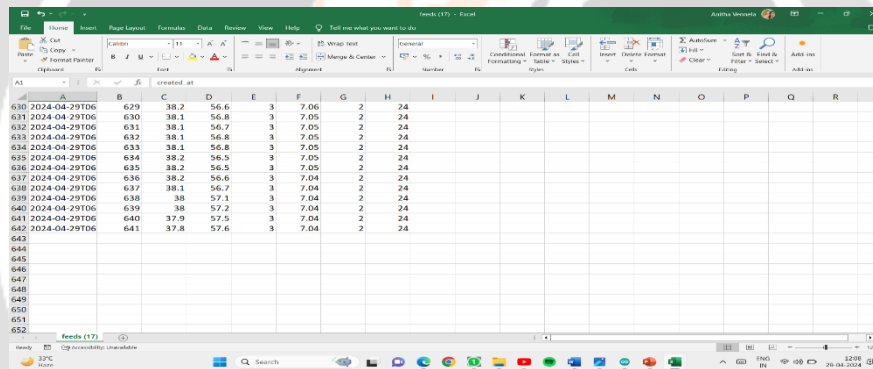


Fig -10: Data of milk parameters stored in Excel Sheet

Table -1: Comparison of milk parameters of two samples

Milk Parameters	Sample1	Sample2
pH	7.1	6.86
Temperature	37.10	37.30
Humidity Percentage	62.40	53.70
Gas Percentage	3	3
Fat Percentage	1	2
Liter Price	40	45

Applications

1. The project includes the billing system for the milk based on its parameters like Fat Percentage.
2. The project includes storage of milk parameters using ThingSpeak Cloud, helps dairy stakeholders can leverage real-time data analytics and visualization tools to monitor milk quality, optimize production processes, and ultimately enhance product quality and safety.
3. The storage of tested milk in hours is analyzed using ThingSpeak graphs and each 15 seconds sample is updated in excel sheet.

4. CONCLUSION

The Automatic Milk Quality Analysis system with billing system is an embedded system integrated with cloud monitoring which is implemented with an aim of ensuring milk quality and safety in various agricultural and dairy applications. The system displays parameters of milk quality, including fat content, gas composition, temperature, humidity, and pH, using Arduino-based sensors. Through careful calibration and data collection, the system provided real-time measurements that were transmitted to Thing Speak for analysis and monitoring and displays the storage of tested milk in hours. The system ensures the production of safe, high-quality milk while maximizing efficiency and profitability throughout the supply chain.

5. REFERENCES

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