



AN EARLY DETECTION SYSTEM OF MILK ADULTERATION USING ARTIFICIAL INTELLIGENCE

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ABSTRACT

Demand for milk among the current generation has resulted in an increase in the number of milk centers across many regions. High-quality milk is thick and free of impurities when it comes to consumption. For the milk industry to stay afloat and increase output, adulterants are routinely added to the product. Milk tampering has recently grown in prominence as a social problem. Contaminated milk can cause serious health problems if consumed. Dairy adulteration must be detected and prevented with precision and consistency. To detect milk adulteration, a color sensor is employed. Additionally, the IoT platform should be updated to reflect the current value. Using this implementation, the depositing of milk should be more obvious to everyone. An Arduino microcontroller is used in this system. The entire milk analyzer setup is controlled by this Arduino. Various methods are used to connect sensors to controllers. Using this method is simple and straightforward.

Keywords: Milk Adulterated, TCS3200 Color Sensor, GPS, ThingSpeak IoT.

1. INTRODUCTION

IoT refers to a network of material devices, transportation methods, and other equipment that are surrounded by electronic and software components, sensors and actuators, and system connectivity that allow these devices to collect and exchange data. For example, IoT allows things to be intelligent or forced diagonally active system communications. This makes it possible for additional straight combination of the material earth into computer-based organization and results in enhanced efficiency, correctness, and financial advantage in calculation to reduce human interference. Merchandise that is perishable is milk. Consequently, it is typically dealt with within a few hours of being gathered. There are a small number of dairy farms and milk processing plants in the United States, totaling around 300,000 across the country. Two milking a day are performed by mechanical vacuum milking machines on dairy cows. The raw milk is transported to a refrigerated bulk milk tank via stainless steel or glass pipes, where it is cooled to a temperature of 40° F (4.4° C). Detection of milk adulteration has become more common in recent years thanks to a variety of chemical tests. These procedures are time-consuming, labor-intensive, and expensive.

The ability to understand the tests is also essential. Milk's importance as a dietary staple for humans is well-known, and it also has a long history of cultural significance in India. The fact that many vendors are adulterating it with water, detergents, caustic soda, starch, formalin and other harmful substances like urea, ammonium sulphate and sodium carbonate is alarming. They have gone to the extreme of producing synthetic milk, which has no nutritional value, because they are so desperate for money. It's a legal term that refers to milk products that don't meet federal or state regulations. Adding another substance to milk in order to increase the amount of milk in raw or prepared form may result in a decrease in the milk's actual quality, which is called adulteration. Due to unsanitary conditions in the processing, packaging, transportation and distribution of milk, it is possible for milk to be adulterated. In order to lower the nutritional value and quality of milk, water is the most used adulterant. Quantitative and qualitative methods have been developed to measure the adulterations. Due to a lack of oversight and policies, milk adulteration is a major problem around the world, but it is especially prevalent in developing countries. In contrast to popular belief, milk adulterants pose serious health risks and can lead to fatal diseases.

2. RELATED WORKS

Biophysical properties of milk can be used as "markers" for adulteration in a new milk quality detection method proposed in this paper. This method is not based on a specific type of adulterant, but rather a universal one. It uses a transduction mechanism to detect milk adulteration that takes advantage of changes in innate milk properties like electrical conductivity and pH. Milk adulteration is common in developing countries because of the high consumption rate and limited supply of milk. A paper-based sensor is used to detect the presence of three adulterants in milk. It is also possible to detect multiple adulterants in milk simultaneously using a 3D paper-based microfluidic device. There is a 0.2 percent (v/v) detection limit for adulterants. In developing countries, this point-of-care sensor can be used for rapid on-the-field testing of milk adulteration.

Temperature sensors and an integrated signal conditioning circuit are part of the prototype's components. Detailing the instrument's calibration process in relation to a given reference solution the error that occurred in each of the prototype's modules is explained in relation to the other modules. The modules' power consumption is being monitored to better design the instrument for use in the field.

Detecting and tracing milk adulteration is a difficult problem. The deterioration of dairy industry products and health risks for consumers can be caused using milk that has been tampered with. Customers and food quality control organizations alike have long sought a low-cost, reliable method for detecting adulteration in food products. Low-cost instrumentation has been developed to detect and quantify milk adulteration in this paper. Based on the results of sensor and computational technology, this paper is presented herein. Laser diffraction changes as a function of particle density, and this can be measured. Casein micelles and fat globules make up the bulk of milk's particle distribution.

3. METHODOLOGY

Humans consume milk and milk products as their main sources of nutrition. In general, dairy products are high in carbohydrates, sugar, protein, vitamins, enzymes, and minerals. However, the quality of nutrients can differ as per the breed of cow, feed, season, lactation stage, and a variety of other factors. The term "adulteration" refers to the addition of other substances in milk to increase the amount of raw milk available. Besides, contamination of milk may occur during unsanitary processing, packaging, and distribution. The most popular adulterant used for milk is water, which raises the quantity of milk while lowering the quality. The consistency of milk is also affected by various environmental factors such as temperature, humidity, and darkness.

Refrigeration and vacuum storage are commonly used to control such factors. Despite India being the largest milk producer across the world, milk consistency and hygiene are major concerns here. To avoid adulteration milk needs to be analyzed for consistency. It is common knowledge that adulterated milk is sold and consumed in India, which includes adulterants such as detergent, water, urea, starch, and other adulterants. Such adulterants lower the nutritional value of milk along with lowering its consistency. As the relation between the milk constituents is secure, it can be used to assess the level of adulteration in the milk. As per a national survey conducted across the country, approximately 68.4% of the milk samples tested did not fulfill the set milk requirement. Thus, it is imperative to monitor milk quality monitored at the dairy farm by the farmer using a clear, accurate, hand-held adulteration detection device or computer that can detect color and other adulterants in milk.

The Arduino-based milk quality and quantity estimation is presented in this study. Customers will use their cell phones to access milk parameter data in this proposed framework. Using an Android smartphone application such as a serial Bluetooth terminal, data can be saved in their mobile memory as a Milk Log. The real-time clock module records real-time milk parameters such as color sensor milk adulteration. The amount and types of adulterants added to milk are detected by this method, which analyses the milk content. Electronic devices interfaced with different types of sensors are used to detect adulterants. The level of milk, which is determined by a color sensor, is primarily used to determine the consistency of milk. The odor of milk is detected using a gas sensor. When milk is processed for a prolonged period, microbial activity occurs, altering the scent of the milk.

The key components of this proposed Arduino Uno system are as follows: The UNO version is included in this proposed scheme. A microcontroller is the Arduino Uno. It's an open-source electronics platform board that's a hybrid of hardware and software. It can be directly pre-programmed via USB. It is based on the ATmega328P microcontroller. Digital I/P and O/P pins, Analog I/P pins, 16 MHz ceramic resonators, USB link, a power jack, and a reset button are all included. It's simple to connect to other electronics modules and sensors. It has a 5-volt DC operating voltage. It is a low-cost microcontroller board that regulates the entire device and provides quicker and more reliable results.

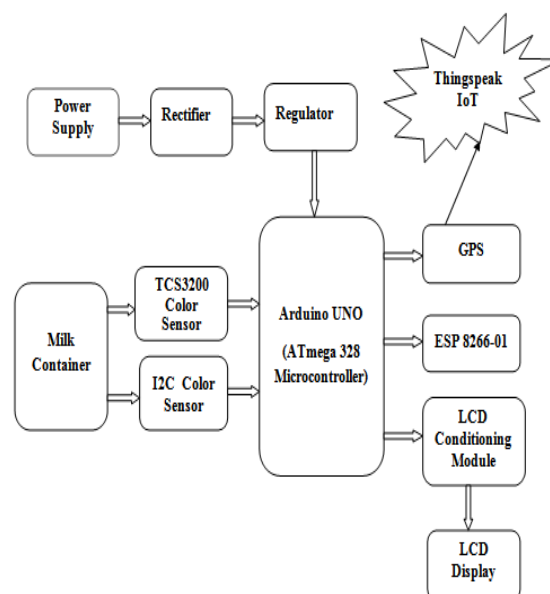
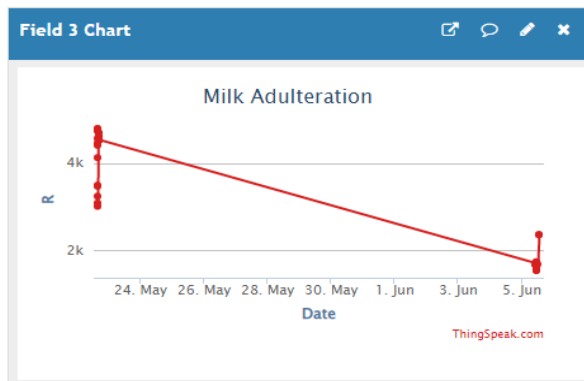
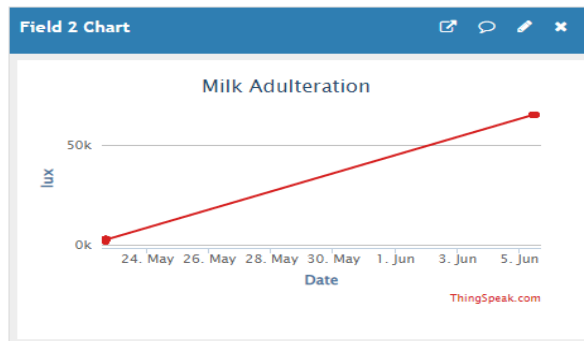
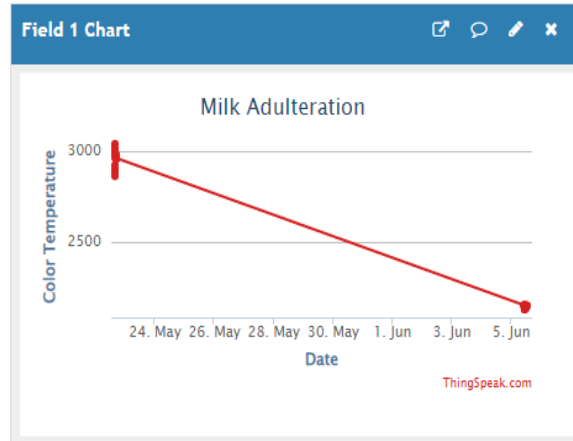
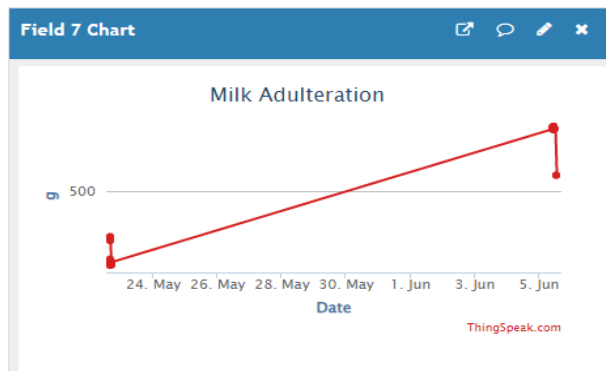
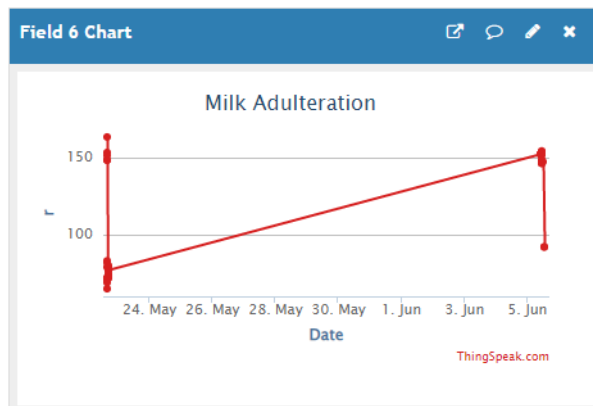
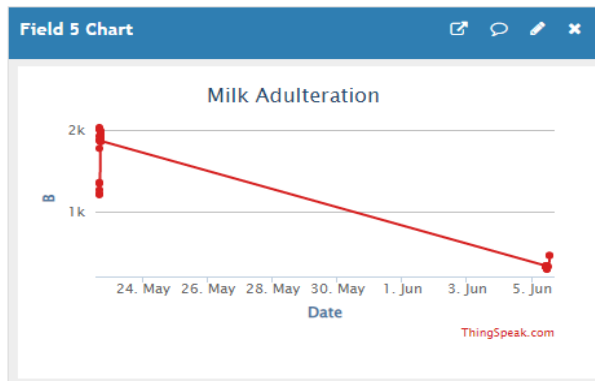
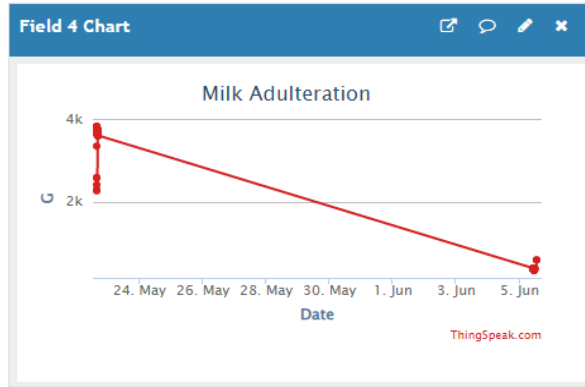


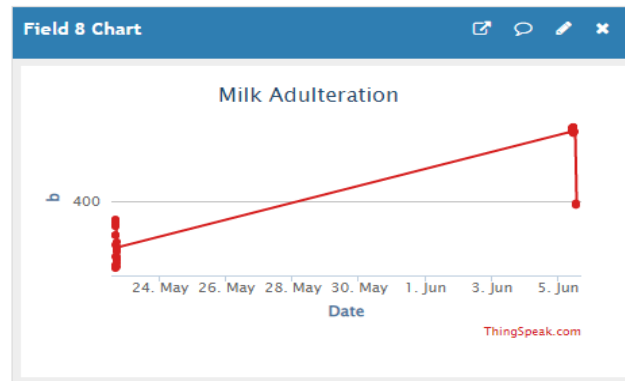
Figure 1: Block Diagram

4. RESULTS AND DISCUSSIONS:

The key components of this proposed Arduino Uno system are as follows: The UNO version is included in this proposed scheme. 12v Power supply board is used to turn on the sensors. The milk quantity is notified with the help of sensor and if any changes occur in the quality of milk, then it will send an alert to user about the status of milk with the location.







5. CONCLUSION

Across many regions, there has been an increase in the number of milk centers due to a growing demand for milk from the current generation. When it comes to consumption, high-quality milk is thick and free of impurities. Milk is regularly adulterated to keep the industry afloat and increase production. The issue of tainted milk has recently gained traction as a public health concern. It is extremely dangerous to eat contaminated milk. Detection and prevention of dairy adulteration must be precise and consistent. A color sensor is used to detect milk adulteration. There should be a corresponding update to the IoT platform itself, as well. Everyone can see where the milk is being stored now that this method has been put into place. This system employs an Arduino microcontroller. Using this Arduino, the entire milk analyzer system can be controlled. Sensors can be connected to controllers in a variety of ways. You don't have to be an expert to use this method.

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