ELECTRONIC BASED ARTIFICIAL INTELLIGENCE SYSTEM FOR MILK QUALITY ANALYSIS

Amodini Singh[1] ,Anamika[2] ,Jyotsana Tanwar[3], Kaveri Bhagat[4] , Prof.Rajashekhar B.S.[5]

[1,2,3,4] *UG Student*   [5] *Project Guide*

[1,2,3,4,5] *Department of Electronics & Communication Engineering*

[1,2,3,4,5] *Sambhram Institute of Technology, Bangalore-97, India.*

ABSTRACT

In local areas to increase the yield of milk and in order to keep milk temporarily fresh, some unethical activities are usually adapted to prevent the financial losses due to the spoilage of milk during its transportation and sale. Certain adulterants are added in milk, which may affect the nutritional quality of milk. Adulterants like detergents, urea, ammonia etc. are added which can cause irritation in the gastro-intestinal tract, vomiting, diarrhoea and some of them are also neurotoxin. Thus, milk adulteration is dangerous for human health. In most cases, the dairies use devices such as lactometer, refractometer etc. to detect the quality of milk and to detect sugar, urea and water. Even though lactometer is generally used to measure the purity of milk it is not reliable instrument, it fails to give the correct assessment of purity if the density of skimmed milk is made equal to that of pure milk by adding water in an appropriate proposition along with the adulterants.

This project analyses the quality of milk by detecting amount and types of adulterants that are added. Here we are detecting pH, odour, taste, temperature and types of adulterants in milk thereby knowing whether it is consumable or not. In this, all the sensors are combined to form compact and flexible system which analyse and classify the quality of milk into different grades and finally output displayed on LCD screen. Problem faced in small diaries and by the individuals can be prevented by detecting the quality of milk, and also prevent from causing the hazardous diseases by detecting the adulteration of milk.

Keywords- milk adulteration, lactometer, refractometer, electronic sensors.

I.INTRODUCTION

Milk is the primary source of nutrition for mammals. The principal constituents of milk constitute of carbohydrate, fat, protein, vitamins and minerals, enzymes etc.Milk is
an emulsion or colloid of butterfat globules within a water-based fluid that contains dissolved carbohydrates and protein aggregates with minerals. Because it is produced as a food source for the mammals, all of its contents provide benefits for growth. The principal requirements are energy (lipids, lactose, and protein), biosynthesis of non-essential amino acids supplied by proteins (essential amino acids and amino groups), essential fatty acids, vitamins and inorganic elements and water.

The pH of milk ranges from 6.5 to 6.8 and it changes over time.[1] Milk from different mammals varies in composition, but has a similar ph. Normal milk contains 30–35 grams of protein per liter of which about 80% is arranged in casein micelles. Total proteins in milk represent 3.2% of its composition.Milk contains several different carbohydrate including lactose, glucose, galactose, and other oligosaccharides. The lactose gives milk its sweet taste and contributes approximately 40% of whole cow's milk's calories.

Good-quality raw milk has to be free of debris and sediments free of off-flavors and abnormal color and odor, low in bacterial count, free of chemicals (e.g., antibiotics, detergents); and of normal composition and acidity. The quality of raw milk is the primary factor determining the quality of milk products. Good-quality milk products can be produced only from good-quality raw milk.

Adulteration in milk has been a cause of concern for both the Government and the Dairy Industry.[2] 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-termeffectsarefarmoreserious.Milk is most commonly diluted with water, it not only reduces its nutritional value, but contaminated water can also cause additional health problems. Adulterants and preservatives reduces the quality of milk and can even make it hazardous.[3] Adulterants like soap, acid, salt, table sugar, flour and urea . Chemicals like formalin, H_2O_2, sodium carbonate, hydrogen peroxide, and ammonia. may be added to milk. So, for preventing these, determination of milk adulteration is very important.

II.METHODOLOGY

Take the sample of fresh/adulterated milk. Power ON the device and once the device is ON,whole system is initiated. Three types of tests will be performed with the milk sample, those are fresh milk test, grade test, adulteration test. Firstly, the fresh milk test is performed to detect pH, odour, taste and temperature of the milk sample. The pH is measured by using the pH sensor and if the value ranges from 6.5 to 7.0 then the milk is normal andif it is above or below the range of 6.5 to 7.0 then there is some abnormalities in the quality of the milk sample. Then the odour is measured by using air quality sensor, if the value ranges from 101-120 ppm then the milk is good otherwise average/bad. Taste depends on conductivity and pH of the milk, where the conductivity is measured using the conductivity cell which measures the charge accumulated around it. If the conductivity value ranges between 250-300 mho then the milk sample taken is edible. If the quality of the milk sample is good, then the milk sample is fresh and no further tests are required otherwise the milk sample will undergo further test.

Next test performed on the milk sample is grade test which will assign the grade based on their parameter values.Grade A will be assigned if the milk sample is of high quality and as the quality of the milk decreases the grades B, C, D and E will be assigned accordingly.

Low grade milk indicates that adulterants are present in the milk sample and to detect the adulterants present in the milk sample the adulteration test will be performed next.Presence of adulterants in milk releases toxic gases which can be detected using different sensors. Adulterant like urea, hydrogen peroxide, formalin, chlorine etc. are some of the adulterants that are added in milk.[4]Urea is added in the milk to increase its quality that releases gases like ammonia and carbon dioxide. Hydrogen peroxide is added as a preservative. Formalin is added in the milk to enhance its life. Chlorine is added in the milk to increase the density of the milk. Detergents increases the fat value and masks adulterants. Sugar and salt are mixed to increase the lactometer reading to mask dilution with water. These adulterants are detected using different gas sensors like mq136, mq137, mq138, mq3, mg811 etc. The result of the gas sensors will be shown on the LCD screen one by one as we press the respective buttons on the keypad.

Figure 1. Milk quality analysis prototype model
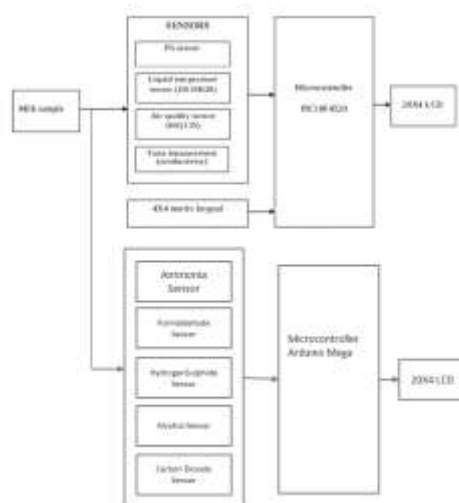
III.BLOCK DIAGRAM

Figure 2. Block Diagram of milk quality analysis system.

The system consists of pic 18F4520 microcontroller to which the pH sensor, temperature sensor(DS18B20), air quality sensor(mq135) and the conductivity cell is externally connected. The 20X4 LCD is interfaced with the pic 18F4520 microcontroller to display the result. The system also consists of Arduino Mega microcontroller. The different sensors like ammonia sensor(mq137),formaldehyde sensor(mq138),hydrogen sulphide sensor(mq136),alcohol sensor(mq3) and carbon dioxide sensor(mg811), which are used to detect the adulterants in milk are interfaced with the Arduino mega microcontroller. And the result is displayed in the separate 20x4 LCD. The system has a 4X4 matrix keypad for the selection of different tests to be conducted.

IV.RESULTS

The values obtained from various sensors in the model is analyzed, calibrated, configuredand classified into different grades. These grades determine the quality of the milk based on thevarious parameters. The quality of the milk will also depend on the type of chemical added as a preservative or adulterant in the milk. As the chemicals will liberate some amount of gas when added in the milk, thus it is is detected by the different types of gas sensors kept on the milk container such as CO2 gas sensor, ammonia gas sensor etc. As a result, the system indicates the presence of adulterants such as sugar, soap, salt, and other chemical adulterants. The operation of the system is controlled by hex keypad. The final result is displayed on the LCD screen.

V.CONCLUSION

All the sensors are combined to form compact and flexible intelligent system,which analyze and classify the quality of milk into different grades, also the hazardous chemicals which are added as adulterants or preservatives in the milk are detected using this system. Thus, problem faced in small diaries and by the individuals can be prevented by detecting the quality of milk,and also prevent from causing the hazardous diseases by detecting the adulteration of milk.

VI.FUTURE WORK

This project is implemented using PIC18F4520 microcontroller. All the sensors are combined to form compact and flexible system which analyze and classify the quality of milk into different grades and finally output displayed on LCD screen. Problem faced in small diaries and by the individuals can be prevented by detecting the quality of milk, and also prevent from causing the hazardous diseases by detecting the adulteration of milk.

In future this project can be implemented in small and large milk diaries for digital milk analyzers. It can be interfaced with a PC and printer so as to save the result and to give the analysis report for further references. If the display unit is of PC then the graphical representation of results can be plotted into graph.

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