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Economical Method of Milk Adulteration Detection

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ABSTRACT

As we know Milk is source of important Nutrients such as Protein, Calcium, carbohydrate, lactose and others. Sold by well known brands such as Amul, Vikas and Chitade other than these local vendors such as local dairy, individual farmer also sold milk without doing any quality tests and certification. Adulteration in milk is considered to reduce the quality and to increase the quantity of milk hence to make more money from less amount of milk local vendors adulterd milk with various chemicals and this adulteration is very dangers for human health and life. This is very important topic for our health and hence this paper highlights on some common Adulterants used for adulteration of milk such as Urea, Satrch, detergent, Coustic Soda, Cane Sugar, Formalin and Oils etc. and our proposed method used to detect adulterants in milk with help of electronics sensors, microprocessor and display devices.

Index Terms—Milk Adulteration, protein, calcium, many other nutrients.

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I. INTRODUCTION

One glass of unadulterated whole milk contains approximate 250 to 260mg of calcium, 8 to 9gms of fats and proteins around 140 to 150 kcals and other vitamins and minerals in milk and hence milk is important part of a healthful diet for Indian people of all ages. Drinking milk has various benefits include improved cardiovascular, strengthening bones and oral health. Adulterants are mainly added to gain more profit from available milk milk. When we buy milk we have the right to consider milk will be adulteration free and pure to drink, But it is not always, It is heartbreaking to say that most Indians are ready to accept to drinking milk diluted with extra water that not only affect quality of milk but the nutritious value of the beverage also poses risk to health. The solute also called as the dispersed phase and solvent is known as the continuous phase. another examples of emulsions include salad, margarine, cream, and mayonnaise dressing. mixture of sugar in water and chalk in water that is true solution are the examples of colloidal solution colloidal solution has some characteristic such as electric charge, small particle size and affinity towards water molecules. if we see example of milk there whey proteins are the colloidal solution, color of milk is pale which is secreted by mammary glands of mammals. till mammals are not able digest a food there primary source of nutritions is milk, in early stage of baby milk carry colostrums and antibiotics to protect baby from diseases and viruses that can reduce risk of many diseases which are harmful for baby till he/she has hot its own immune system

Whenever we buy milk, we assume that it will be pure for drinking and free from any kind of dilution means unadulterated. But, we are not right always, most of Indians accepted that drinking milk with diluted water for their day today activities and this is very sad note for us because by drinking water diluted milk we risk our health and hence Delhi chief minister sheila dixit says:“we have big problem in front of us we need to set up more and more laboratories to test milk and regulate strict policies on milk because Indians are largely vegetarian society which realise on milk other than nonveg for there nutritional needs”. as we know normally milk adulteration is done by vendor to gain more financial profit or lack of hygiene during of Processing[1], transportation marketing and storing such type of adulteration are common in developing countries where milk demands are high and result of this consumer either become victim and cheated for their health and may cause diseases. It is very important for the consumers to have information about common adulterants and their side effects on there health. Milk is produced and processed throughout whole year

almost every day, but in summer month it reduces due to heat stress or scarcity fodder because of Milk is a perishable commodity hence in summer months it mostly get spoiled because if high temp conditions during transportation and hence The middlemen therefore add chemicals for preservation of milk such as hydrogen peroxide, sodium bicarbonate[2], penicillin, streptopenicillin, formaldehyd. then transported through transportation medium and middle-class men called "dudh valla" and because of high demands of milk, milk is diluted with water or skimmed to multiply profit. hence trying to maintain milk composition with the help of materials like flour, urea, cane sugar, starch and vegetable oils are added as adulterants to increase quantity of milk or to satisfy milk test conditions.

To take more benefits out of our project, we decided to make people aware about of milk adulteration and also take strict action to reduce milk adulteration in mandi and their adjoining villages as it cause very bad effect on every age people health And spread awareness in community people and if possible to find a technical solution for this problem. as we read abstract and introduction next section gives information about literature of milk adulteration, section 3 gives information about common adulterants, section 4 Contains Information about Basic blocks of proposed system and detailed information of system blocks and working, section 5 Contains Information about Components and Flowchart of proposed system with detailed information, section 6 conclude this work in last section future scope described.

II. LITERATURE REVIEW

The adulteration of food products is a significant problem in the food production. This is how fraudulent producers try to cheat consumers and authorities. The adulteration affects all commodities in the food processing. Most frequently, such products are adulterated that are produced in big quantities and further, the expensive products whose adulteration brings a profit. Finally, we explore the different kinds of adulterants in milk usually added.

TABLE I COMMON ADULTERANTS IN MILK

Adulterant	Diseases caused
Water dilution	This not only reduces its nutritional value, but contaminated water can also cause additional health problems.
Urea	Vomiting, nausea and gastritis.
Starch	Solid milk paste can cause stomach diseases
Detergent	The detergent contains sodium, can act as slow poison for those suffering from hypertension and heart ailments.
Caustic Soda	Dangerous for people suffering from hypertension and heart ailments. Harms the mucosa of the food pipe, especially in kids
Cane Sugar	Decreases the nutritious value of the milk
Formalin	Causes more severe damage to the body like liver damage
Oil	Gives creamy texture to the milk but at the same time is very bad for consumption

A. History

In a study conducted by Faraz. A. et al on milk adulterations, the authors conclude that the results of the physical examination, chemical composition, physio-chemical properties and milk adulteration clearly showed that the milk sold at the places surveyed by them was extensively put to the malpractices such as skimming and adulteration of milk with water, urea, formalin, hydrogen peroxide and cane sugar which was carried out during the handling of milk starting from milking till the receiving by end consumer[3]. "Milk and kids" are virtually synonymous in our culture with "good health." But that wasn't always the case. Until the early 1900s, milk was often adulterated with foreign substances, taken from sick cows, or mishandled during milking and storage. As a result, it was often host to tuberculosis, cholera, typhoid fever, and other life-threatening diseases[4]. But few people knew that the milk made them sick. It wasn't until the late 19th century, when scientists began to understand germ theory, that they realized diseases were being transferred through milk -and that they could do something to eliminate the hazard.(Miss Cellania, Monday, January 17, 2011 at 5:02 AM)

1) Identification of substances used in Adulteration: An adulterant is a substance found within other substances although not allowed for legal or other reasons. The addition of adulterants is called adulteration. The adulterants/preservatives assume the proportion of health hazards for end consumers, particularly infants Suppliers of milk appear to have found three ways to increase their margin from the sale of milk: (i)dilution (ii) extraction of valuable components, i.e. milk fat removed as cream, and (iii) a combination of (i) and (ii) with the addition of cheap (and sometimes potentially harmful) bulking additives, such as low quality flour, to bring the total solids to a level which is acceptable to consumers. Some of the chemicals, adulterants and malpractices results in public health concern and malnutrition.

III. MATERIALS AND METHODS

A. Adulteration Tests:

Water: The presence of water can be detected by putting a drop of milk on a polished slanting surface. The drop of pure milk flows slowly leaving a white trail behind it, whereas milk adulterated with water will flow immediately without leaving a mark.

B. Starch:

Add a few drops of tincture of Iodine or Iodine solution. Formation of blue colour indicates the presence of Starch.

C. Urea:

Take a teaspoon of milk in a test tube. Add half teaspoon of soybean or arhar powder. Mix up the contents thoroughly by shaking the test tube. After 5 mins, dip a red litmus paper after half a minute. A change in colour from red to blue indicates the presence of Urea in milk.

D. Detergent:

Shake 5-10 ml of sample with an equal amount of water. Lather indicates the presence of detergent.

E. Synthetic Milk:

Synthetic milk has a bitter taste, gives a soapy feeling on rubbing between the fingers and turns yellowish on heating. The milk can easily be tested by Urease Strips (available in the Medical store). The colour chart of the Urease Strip test given below will show the quantity of Urea present in Milk.

F. Test for Glucose/Invert Sugar:

This kind of sugar syrup is added to milk to increase the consistency and enhance the taste. Take a diabetic test strip and dip it in the milk for 30 seconds to 1 minute. If the test strip changes colour, then it shows that the sample of milk contains glucose. If there is no change in the colour of the strip it proves there is no glucose in the milk.

G. Presence of Starch in Dahi:

Take about 5 ml of sample in a test tube. Bring to boiling condition and allow the test tube to cool to room temperature. Add 1-2 drops of iodine solution to the test tube. Development of blue colour indicates presence of starch which disappears when sample is boiled and reappears on cooling. The limit of detection of method is 0.02 %.

H. Detection of Gelatine in Cream:

Gelatine may be detected by Stokes Test. Mix together 10 ml cream, 20 ml water and 20 ml of Stokes reagent (Dissolve mercury in twice its weight of concentrated nitric acid and dilute to 25 times the volume with water). To the filtrate add an equal volume of saturated picric acid solution. Yellow precipitate is produced in presence of considerable amount of gelatine; smaller amounts are indicated by cloudiness.

I. Presence of Sucrose in Khoa:

Take about 5 ml of prepared sample of khoa in a test tube. Add 0.2 ml of iodine solution to the test tube and mix well. Development of blue colour indicates presence of starch and control sample remains yellow. The limit of detection of method is 0.05

IV. BASIC BLOCKS OF PROPOSED SYSTEM

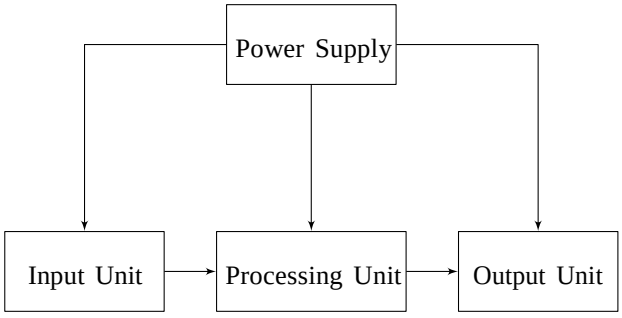

Fig. 1. Basic Blocks of Proposed System

figure 1 shows basic blocks used into proposed system it contains 4 basic blocks namely power supply, Input Unit, Processing unit and Output Unit detail description of basic blocks of proposed system is described in this section.

A. Power Supply Unit

Power supply unit used for providing required voltage to remaining blocks for their proper functioning, it consist step down transformer which converts input 230V AC in to 12 volt AC voltage then converted voltage is provided to rectifier circuit for conversion AC on DC Voltage after conversion of DC voltages converted voltage is provided to filter circuit which gives pure DC Voltages and removes remaining AC component present in Converted DC supply after that pure DC provided to remaining blocks with help of connecting wires

B. Input/Sensor Unit

Input/Sensor Unit is used here for Sensing various parameters such as Amonia, temprature of Milk, PH of Milk and continuity of milk which is important for processing and concluding result.

C. Processing Unit

Processing unit is used for process output signal out from Input section and conclude the result and display calculated results on the output/Display unit. Atmega328 ic is proposed to use as processor for calculating result and display on LCD.

D. Output/Display Unit

Output/Disply Unit shows output calculated by processing unit, in this unit to show output calculated by Atmega328 we proposed to use 16*2 LCD.

V. COMPONENTS AND WORK FLOWCHART OF PROPOSED SYSTEM

A. pH sensor:

pH (potential of hydrogen) is a measure of the hydrogen ion concentration in water. This means is that for every tenfold change in hydrogen ion concentration, there is a one unit change in pH. pH is a numeric scale used to specify the acidity or basicity of an aqueous solution pH = -log[H+] It is approximately the negative of the base 10 logarithm of the molar concentration,measured in units of moles per litre, of hydrogen ions. More precisely it is the negative of the logarithm to base 10 of the activity of the hydrogen ion. The pH scale is usually said to run from 1 to 14. Solutions with a pH less than 7 are acidic and solutions with a pH greater than 7 are basic[5]. Pure water is neutral, at pH 7, being neither an acid nor a base.

B. Temperature sensor:

A temperature is an objective comparative measurement of hot or cold. It is measured by a thermometer. Several scales and units exist for measuring temperature, the most common being Celsius (denoted ^0C; formerly called centigrade), Fahrenheit (denoted ^0F), and,especially in science, Kelvin (denoted K)[6]. Milk has its own temperature criteria which should be maintained during storage, even if the milk is mixed with water or with any toxic materials the temperature of the milk will not be in the normal range. Generally milk will be safe at the temperature range of 35-40^0F above or below which the formation of bacteria occurs and thus not fit for consumption.

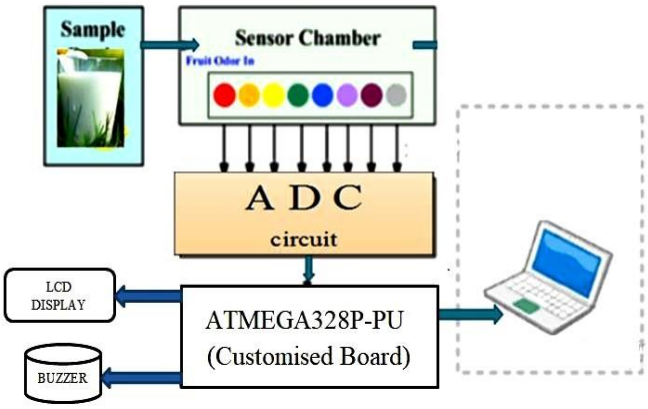

Fig. 2. Components used in Proposed System

C. Air quality sensor:

The concentration of odor will vary from fresh milk to toxic milk. When the toxicity in milk is high it tends to release toxic gases which come out as bad odor from the milk when milk is preserved for a very long time or due to external contamination. So it is necessary to detect the gases releasing out from sample which are nothing but bad odour in general. That can be done by the air quality sensor (MQ135)[7].The MQ series of gas sensors utilizes a small heater inside with an electro chemical sensor these sensors are sensitive to a range of gasses are used at room temperature. Air quality sensor.Sensitive material of MQ135 gas sensor is SnO2, which with lower conductivity in clean air. When the target combustible gas exist, the sensors conductivity is higher along with the gas concentration rising. Please use simple electro circuit, Convert change of conductivity to correspond output signal of gas concentration. MQ135 gas sensor has high sensitivity to Ammonia, Sulfide and Benzene steam, also sensitive to smoke and other harmful gases. It is with low cost and suitable for different application

D. Conductivity sensor:

Taste is something which is dependent on the pH and conductivity of particular substance as the adulterants added to the milk will have different conductivity. Conductivity of solution depends on the concentration of all the ions present. Greater the concentration greater will be the conductivity. Since pH is a measure of H+ ions, for an acidic solution PH will be lower [higher H+ ions], hence greater will be the conductivity. Similarly higher the pH lower will be the conductivity for basic solution.Initially take a fresh milk sample which will have the normal pH and conductivity values. The taste depends on chemical substances involved in milk and those chemical substances will have its own pH and conductivity values. So any toxic material or milk preserved for very long time will literally have additional chemical substances in it[8], which are not consumable and those toxic contamination formed are developed by addition of toxic materials externally or by long preservation process will develop different taste or bad taste, change in the taste can be measured using conductivity sensor.

E. Micro-Controller:

PIC micro-controllers are a family of specialized microcontroller chips produced by Microchip Technology in Chandler, Arizona. The acronym PIC stands for ”peripheral interface controller”, although that term is rarely used nowadays. A micro-controller is a compact microcomputer designed to govern the operation of embedded systems in motor vehicles, robots,office machines, medical devices, mobile radios, vending machines, home appliances, and various other devices[9]. A typical micro-controller includes a processor, memory, and peripherals.Every PIC micro-controller architecture consists of some registers and stack where registers function as Random Access Memory (RAM) and stack saves the return addresses. The main features of PIC micro-controllers are RAM, flash memory, Timers/Counters, EEPROM, I/O Ports, USART, CCP (Capture/Compare/PWM module), SSP, Comparator, ADC (analog to digital converter), PSP (parallel slave port), LCD and ICSP (in circuit serial programming) The 8-bit PIC microcontroller is classified into four types on the basis of internal architecture such as Base Line PIC, Mid Range PIC, Enhanced Mid Range PIC and PIC18. Micro-controller

F. LCD Display:

Here the LCD (liquid crystal display) used 20x4 characters LCD. This is a basic 20 character by 4 line display. This will display the final classified values and graded result.A liquid crystal display (LCD) is a flat panel display, electronic visual display, or video display that uses the light modulating properties of liquid crystals (LCs). LCs do not emit light directly. They are used in a wide range of applications, including computer monitors, television,instrument panels, aircraft cockpit displays, sign age, etc. They are common in consumer devices such as video players, gaming devices, clocks, watches, calculators, and telephones. LCDs have replaced cathode ray tube (CRT) displays in most applications. They are available in a wider range of screen sizes than CRT and plasma displays, and since they do not use phosphors, they cannot suffer image bum-in[10]. LCDs are, however, susceptible to image persistence.

G. Flow chart:

The first step is to identify the milk adulteration, what are all chemicals present in adulterated milk. Identifying the respective E-nose sensors. Collection of various milk samples. Interface sensors and get the data values. Using these values differentiate milk samples.

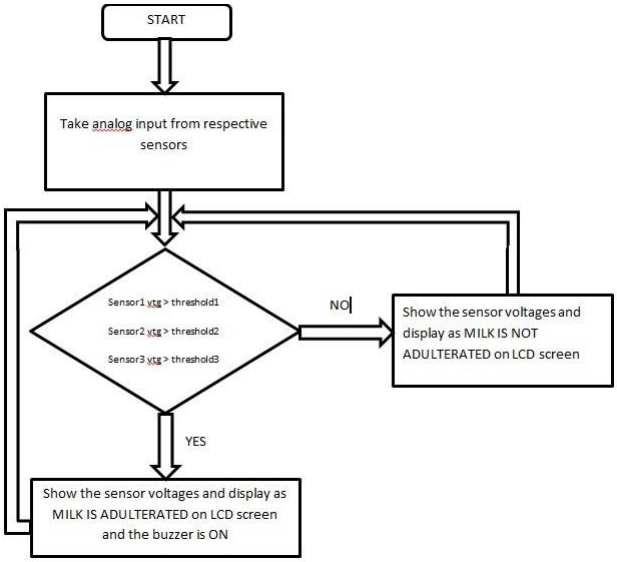

Fig. 3. Flow Chart of Proposed System

The figure 3 shows that the flow chart of the project. The very first step is to taking the analog inputs from various sensors and that analog voltages are compared with the specified threshold voltages of respective sensors, if any one sensor voltage exceeds the corresponding threshold voltage then it displays "MILK IS ADULTERATED". If all conditions are false then the display will shows "MILK IS NOT

VI. CONCLUSION

After surveying about testing the milk samples, the results were quite shocking. People only expected water to be present as an adulterant in their consumed milk but for some cases tests indicated the presence of other adulterants that are harmful for health. Therefore this contradictory information shows that consumers are unaware of these adulteration practices.

So spreading the awareness among the people about different types of adulterants that can be present in milk and harmful effects on their health can be an appropriate recommendation in this case.

VII. FUTURE SCOPE

Existing common detection techniques are not always convenient and accessible in these countries making it difficult to address the diverse ways of fraudulent adulteration in milk. This calls for combined efforts from scientific communities and the regulatory authorities through the development, implementation and dissemination of better techniques for the detection of milk adulteration. In addition, awareness and access to information can play vital role in these regions to overcome this issue. Some of these easy detection methods at the consumer level and state of the art techniques at the authority level can bring this problem to an end for the victims, including millions of children in the developing countries.

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