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Detection of Adulteration in Milk Using Embedded

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ABSTRACT: *Milk is a nutritional food for living mammals, which is good for health. The quality of milk is essential for the survival of living beings on earth. The high quality milk should have better density and is free from the adulterants. Now-a-days milk adulteration is a social problem. Consumption of adulterated milk causes serious health problems and a great concern to the food industry. So it is necessary to ensure the quality of milk by measuring type and amount of adulterants that are added to the milk. This is performed by using combined electronic sensory instrumental system such as ph sensor, conductivity sensor, air quality sensor, urea detector sensor.*

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I. INTRODUCTION

A national survey in India state that 70% of milk sold and consumed in India is adulterated by contaminants such as a detergent and impure water, impure water is most Harmful. Usually the adulteration will make the product more profitable, while the fraud goes undetected. Milk adulteration is very common food fraud and is posing a big social problem in today's world.

Medical research has reported that milk adulterants have a hazardous health effects. The detergent in milk can causes food poisoning and other health complications. The other adulterants are mainly detergent, foreign fat, starch, sodium hydroxide, salt, sugar & urea. For a detection of adulterants sophisticated instrument is required. With the advancement of technology, newer techniques have been invented t detect different kinds of milk adulterants, but in the same pace the complex methods of milk adulteration and varieties of milk adulterants have been evolved.

In this paper it is going to analyze the quality of milk by detecting adulterants that are added, This system mainly has four different parameters to be measured such as a pH, urea, conductivity and toxic gases by use of pH sensor, urea detector sensor & air quality sensor.

II. BLOCK DIAGRAM

2.1.1 Milk Samples

Here different milk samples are taken as source which includes fresh milk & adulterated milk.

a) Fresh milk

Initially the fresh milk of about 80ml is taken in glass as sample which has the pH range from6.5-6.8, temperature range from30-35deg C, and also will have good odor. All the sensors in the senor block are dipped in the fresh milk sample and corresponding test is performed.

b) Adulterated milk

Here four types of adulterated milk sample are taken which can be the mixture of 2tbs of sugar,40ml of water and 40ml of milk or 2tbs of salt,40ml water and 40ml milk or 3/4tbs of soap,40ml of water and 40ml of milk or 2tbs of H2O2,40ml of water and 40ml of milk. For each adulterated sample the sensors in the block is dipped, the sensors will detect the change in the standard reference values of pH, conductivity toxic gases, urea and this change in parameter values will be passed to the microcontroller for further calibration.

2.1.2 Sensor Block

The sensor block includes mainly 4 sensors which are used to sense the changes in the standard parameter values. These sensors are:

I) pH Sensor:

pH (potential of hydrogen) is a measure of the hydrogen ion concentration in water. The pH scale is usually ranges from 0 to 14. Solutions with a pH less than7 are acidic and solutions with pH greater than 7 are basic and solutions with pH at 7 are neutral. Every liquid has its own pH value according to temperature and other dependent parameters. So the milk has pH range of 6.5-6.7, above and below of this range milk totally considered as abnormalities in its quality. Here pH is monitored using pH sensor. pH electrodes are glass electrodes. pH sensor is made of glass ended with small glass bubble .inside of the electrode is usually filled with the buffered solution of chloride in which silver wire covered with silver chloride is immersed.

Fig 2.1: pH Sensor

Glass bubble is the active part of the electrode. Tube has strong & thick walls bubble is made to be as thin as possible. Surface of the glass is protonated by both internal and external solution till equilibrium is achieved. Both sides of the glass are charged by the absorbed protons, this charge is responsible for potential difference.

2) Urea Detector Sensor:

The MQ135 gas sensor senses the gases like ammonia, nitrogen, oxygen, alcohol, sulphide and smoke. Urea contains ammonia and MQ135 is very sensitive to ammonia. It has potential to detect different harmful gases. The MQ15 gas sensor is low cost to purchase. The basic image of MQ135 sensor is show in the below figure.

Fig 2.2 MQ135 Sensor

MQ135 Sensor is used for detecting venomous gases that are present in the air in homes& offices. The gas sensor layer of the sensor unit is made up of tin dioxide (SnO2). It has lower conductivity compare to clean air and due to air pollution the conductivity is increases. The air quality sensor has a small potentiometer that permits the adjustment of the load resistance of the sensor circuit. The 5V power supply is used for air quality sensor.

3) Conductivity Sensor:

Conductivity of a solution depends on the concentration of all the ions present. Greater the concentration greater will be conductivity. Since pH is a measure of H+ ions for an acidic solution pH will be lower (Higher H+ ions), hence greater will be conductivity. Similarly higher the pH lower will be the conductivity for a basic solution

To determine the conductivity of milk raindrop sensor is used. Raindrop sensor is basically a board on which nickel is coated in the form of lines. It works on the principle of resistance when there is no any drop on board, resistance is higher so we get high voltage according to V=IR.

Fig 2.3 Raindrop Sensor

4) Air Quality Sensor

When toxicity in milk is higher it tends to release toxic gases which come out as a 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 odor in general. That can be done by the air quality sensor (MQ5). The MQ series of gas sensors utilizes a small heater inside with an electro chemical sensor. These sensors are sensitive to a range of gases are used at room temperature.

Gas sensor (MQ5) module is useful for gas leakage detection (in home & industry). It is suitable for detecting H2, LPG, CH4, CO, Alcohol. Due to its high sensitivity and fast response time measurements can be taken as soon as possible. The sensitivity of the sensor can be adjusted by using potentiometer.

Fig2.4 MQ5 Sensor

5) PIC Microcontroller:

PIC Microcontroller is a family of specialized microcontroller chips provided by Microchip Technology in Chandler, Arizona. The acronym PIC stands for "Peripheral Interface Controller", although that term is rarely used nowadays. A microcontroller 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. A typical microcontroller includes a processor, memory and peripherals.

Fig 2.5 PIC18F4520

Every PIC Microcontroller architecture consists of some registers and stack where registers function as a random access memory (RAM) and stack saves the return addresses.

6) LCD Display:

Here the LCD (Liquid Crystal Display) used 16*2 characters LCD. This is a basic 16 character by 2 line display. This will display the final classified values and graded result.

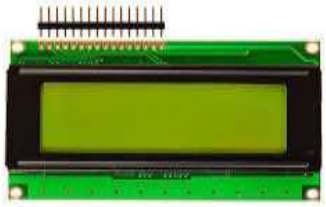

Fig 2.5 16*2 LCD Display

III. WORKING

To overcome the drawbacks of sophisticated techniques for analyzing the quality of milk, "Detection of Adulteration in Milk Using Embedded System" is developed by using different sensory instrumental system which measure the parameter such as pH, urea, conductivity & toxic gases and the final result will be displayed on LCD.

The main working principle of this system is that the standard pH value, conductivity of milk is stored in microcontroller. If the milk is adulterated the standard value which is stored in microcontroller is compared with the displayed value & according to that it display milk is adulterated or not. Programming is done using embedded C. Tool is used to write code into PIC Microcontroller is MPLAB X IDE. Tool used to flash hex file into PIC Microcontroller is PICKit3. For testing proteus design suit is used.

IV. CONCLUSION

This project is implemented by using PIC18f4520 microcontroller. All the sensors are combined to form aCompact and flexible system which analyzes the quality of milk and finally output displayed on LCD Screen. Problem faced in a small dairies and by the individuals can be prevented by detecting the quality of milk ,and also prevented by detecting the quality of milk, and also prevent from causing the hazardous diseases by detecting the adulteration of milk.

V. RESULT

1. Fresh Milk

Sample-1 is the fresh milk which has standard pH .After the fresh milk test the standard parameter value will be displayed on LCD screen.

Sr. no	pH	Air quality	Conductivity	Urea
1.	164	232	368	0%
2.	151	205	383	0%

Table 1.Fresh Milk

2. Fresh Milk + Detergent

Sample-2 is the detergent is added in fresh milk sample. After the test the standard value is compared with standard values of fresh milk sample and result will displayed on LCD screen.

Sr. no	pH	Air quality	Conductivity	Urea
1.	128	255	333	0%
2.	138	253	326	0%

Table 2.Fresh Milk +Detergent

3. Fresh Milk + Salt

Sample-3 is the salt is added in fresh milk sample. After test the standard value is compared with standard values of fresh milk sample and result will be displayed on LCD scree**n.**

Sr. no	pH	Air quality	Conductivity	Urea
1.	114	150	193	0%
2.	120	152	200	0%

Table 3.Fresh Milk +Salt

4. Preserved Milk

Sample-4 is the preserved milk sample. After the test the standard value is compared with displayed values and result will displayed on LCD screen.

Sr. no	pH	Air quality	Conductivity	Urea
1.	193	245	286	0%
2.	192	239	398	0%

Table 4.Preserved Milk

5. Preserved milk + Detergent

Sample-5 is detergent is added in preserved milk sample .After the test the standard value is compared with displayed values and result will displayed on LCD screen.

Sr. no	pH	Air quality	Conductivity	Urea
1.	161	215	249	0%
2.	158	233	265	0%

Table 5.Preserved Milk + Detergent

6. Preserved Milk + Salt

Sample-6 is salt is added in preserved milk sample .After the test the standard value is compared with displayed values and result will displayed on LCD screen.

Sr. no	pH	Air quality	Conductivity	Urea
1.	170	282	219	0%
2.	165	283	257	0%

Table 6.Preserved Milk + Salt

7. fresh milk +urea

Sample-7 is salt is added in preserved milk sample .After the test the standard value is compared with displayed values and result will displayed on LCD screen.

Sr. no	pH	Air quality	Conductivity	Urea
1.	185	274	260	1%
2.	195	295	297	1%

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