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IoT Based Milk Adulteration Analyser

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Abstract: ***Food safety is a more important issue in rural and urban areas as it affects the health of the citizens. Different studies have shown that adulteration of milk is a problem in many countries. Increased adulteration in milk poses a health risk that can lead to life-threatening diseases. So it is necessary to develop a device that allows detection of such life-threatening adulterants present in milk. This is achieved by detecting adulterants in milk using basic principle of spectrometer combined with automated devices.***

Keywords: ***Internet of Things (IoT), Arduino, Spectrometer, Chemical Solutions***

I. INTRODUCTION

Milk adulteration is one of the most dishonest food preparations that have been dominating society for a long time. Adulteration in milk is increasing day by day which causes several health hazards.

Adulteration is usually done by adding some chemicals to the milk. Intake of these chemicals causes various disorders and diseases in human beings. Some of the major adulterants are detergents, urea, common salt, water, soda, etc. These adulterants are used in the preparation of synthetic milk.

According to physicians, consumption of adulterated milk inflicts serious harm on the human body causing swelling in the eyes and complications in the liver and kidney. Apart from this adulterated milk proves deadly for pregnant women and patients suffering from conditions of heart ailment and high blood pressure. Consequently, the consumption of such adulterated milk may result in life-threatening illnesses.

Various quantitative and qualitative methods have been evolved for detecting adulterants in milk. But all these methods are quite complex, time consuming and requires sophisticated instruments. This project focuses on building a device which could detect and analyze milk for adulterants such as starch, urea and detergent. And aims to reduce the complexity required in detecting each adulterant using automated IoT enabled milk adulteration analyser.

II. METHODOLOGY

The proposed system is a low-cost screening detection and quantification of adulterations in liquid milk samples. This device should consider the discrete nature of impurities i.e. adulterants dissolved in the milk and the sensors could detect the measures of the adulterants.

A. System Design

The main system is placed inside the miniaturized container were the system checks for the presence of milk in the test tube, the milk sample provided is added automatically with mere amount of chemical solutions for detecting urea, detergent and starch. If any adulterant is present the colour change is detected using the RGB colour concentration detection sensor. The means of ten colour parameters were used to evaluate the information from images: red, green, blue, hue, saturation, value, relative colours (r, g, and b), and intensity.

As soon as the chemical solution drops are added to the milk sample the drastic change in colour of the milk sample is noticeable and is detected and the amount of adulterant present in the sample is displayed with the name of adulterant. After the detection of the adulterant the tested milk sample is automatically washed off from the test tubes using the diaphragm motor. This technique allows fast and reliable evaluation of milk adulteration.

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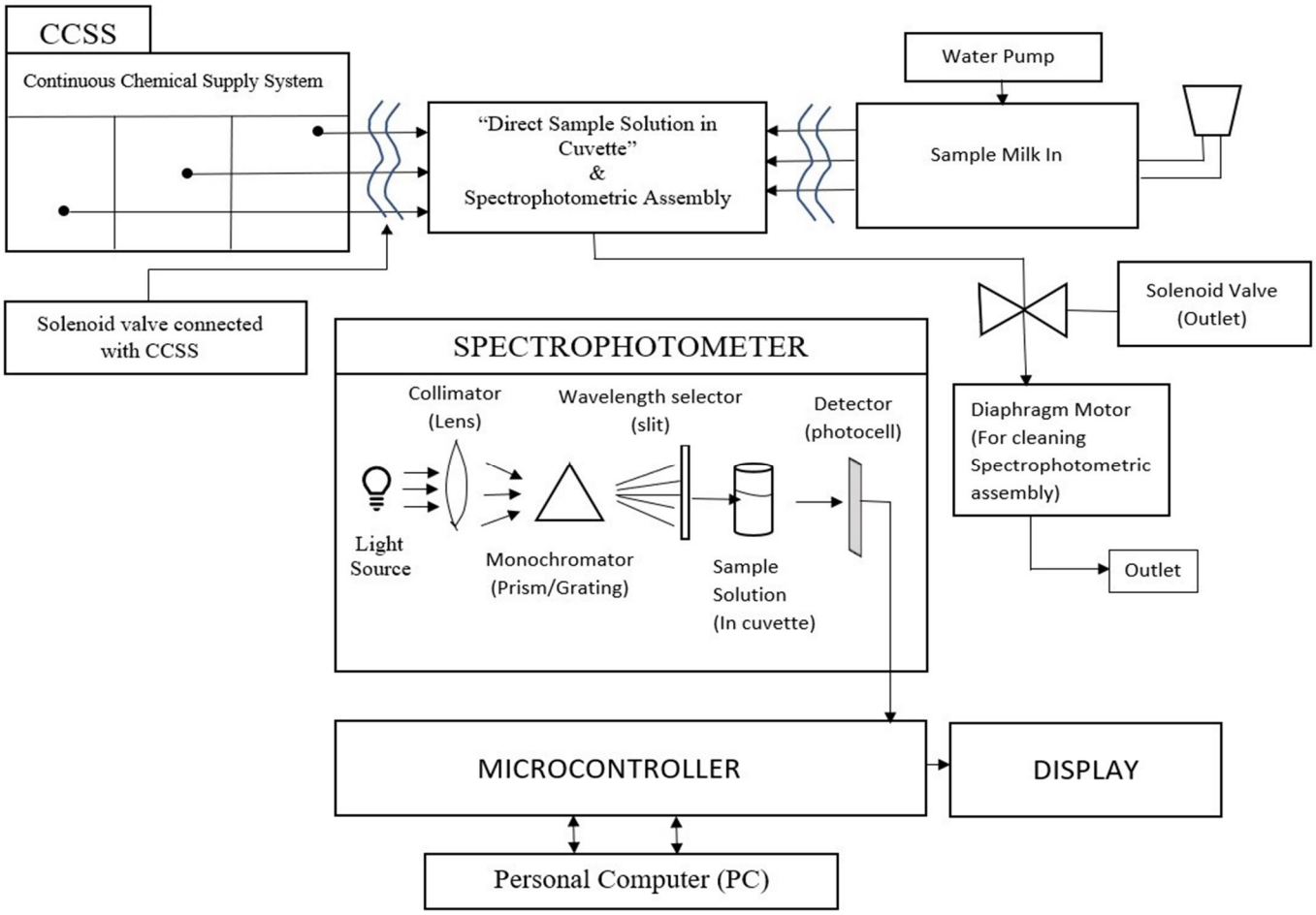


Fig.1: System Design

B. Components Used

1) Arduino: An 8 bit ATmega 328p microcontroller which controls the overall flow of the system. Hence, it plays an important role in atomizing the system. It receives data input from spectrometric assembly and performs needed operation which outputs the detected adulterants from milk samples.



Fig.2: Arduino Uno

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2) *Solenoid Valve:* Solenoid valve is used for electrically controlling the flow of chemicals from continuous chemical solution system and milk and water from spectrometric assembly. Solenoid valve contains an electric coil in its center. When electric current is passed through the coil a magnetic field is created which forces the valve to open and close.



Fig. 3: Solenoid Valve

3) *RGB Sensor:* RGB sensor is useful for color reorganization and observation for food-processing units. It detects the change in colour of milk sample when drops of chemical solution are added within the spectrometer.



Fig. 4: RGB Sensor

4) *Diaphragm Motor:* Diaphragm motor is used to pump out milk sample after testing and water after automatically cleaning the cuvette within the spectrometer.



Fig. 5: Diaphragm Motor

5) *LCD Display:* LCD display stand for liquid crystal display which is used for displaying data. LCD consists of 2 rows and 16 columns. Capacity of LCD screen is to display 32 characters at once. LCD display is used to display the analyzed results of adulterants present in milk.

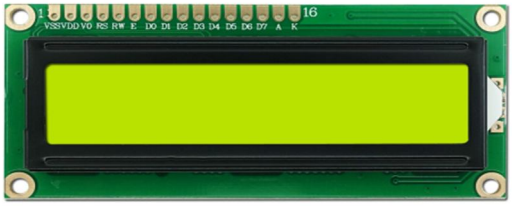


Fig. 6: LCD Display

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III.RESULTS AND DISCUSSION

The deployed milk analyser system shows the following results on LCD display for each test module when being commanded to perform its desired task;

1) On switching on the milk analyzer a message reading "Milk Analyzer" is displayed on the LCD screen which denotes that the system is ready for performing further tasks. After that it requests operator to add milk for analyzing.



Fig. 7: System ready for analyzing

2) When test command is activated the system automatically starts analyzing the milk sample for adulterants and displays the type of adulterant present in milk with its concentration per litter in percentage. And for those adulterants which are not found in milk are displayed as follows:



Fig. 8: Analyzed Results

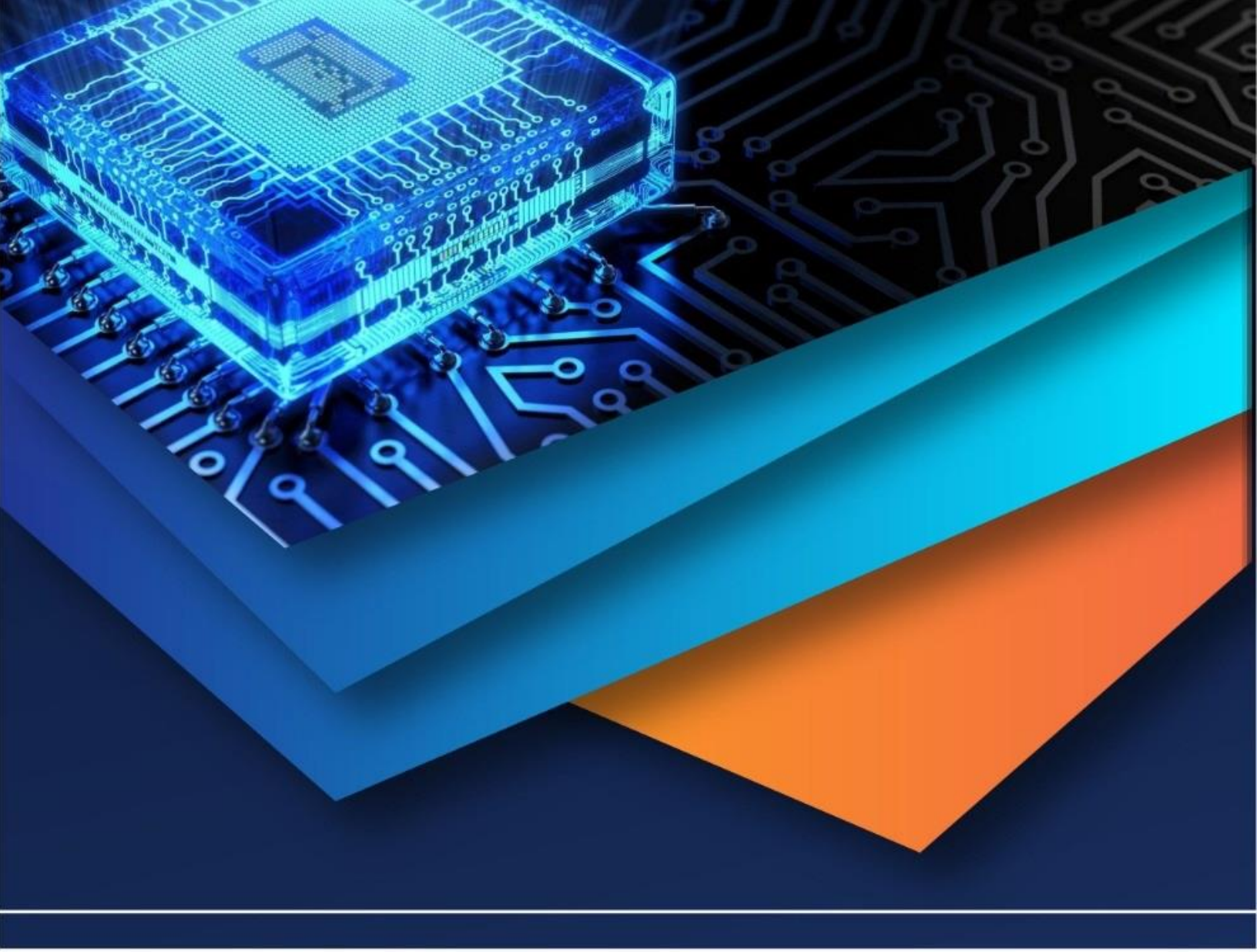
IV. CONCLUSION

The implemented milk adulteration analyser works of the principle of spectrometer to detect adulterants such as urea, detergent and starch in milk. The system is completely automated and controlled using a microcontroller. The system can be connected to computers to store the analysed data for future reference. It replaces those complex methods involved in adulteration detection which are indeed time consuming. Due to its automated sampling and cleaning process it is the best option to choose between sophisticated testing instruments. It also provides ease of portability due to its compact size.

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