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# A Monitoring System for Early Detection of Microbial Activity for Various Milk Products

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***Abstract**: Smart city is a striking new activity by the Administration of India to drive monetary development and to enhance the personal satisfaction of individuals. This endeavor to perceive the innovations that can tackle issues which urban communities must confronting, for example, transportation prototype, poor air quality and wellbeing related issues. Distinctive reviews demonstrates that, Raw milk contains diverse infective microorganisms if such milk get devoured it will influence a sickness and decrease or harm personal satisfaction. In this way, it is important to grow such devices which will an ongoing quality observing with savvy detecting prototype to set aside a few minutes choices. In this venture we will exhibit continuous checking prototype, an apparatus which permits perceiving centralization of various gasses in raw milk. Put away raw milk may contain microorganisms that outcome in undesirable notice, taste and so forth. In the current prototype work has been finished with Ardunio Uno. We are proposing a prototype with Ardunio Uno and different sensors which help to distinguish distinctive microbial exercises Raw milk. This prototype will ready to examine information and furthermore information reinforcement will be kept up in proposed prototype. Our work includes identifying microbial movement show in raw milk Prototype can distinguish such movement effectively by checking nearness of ethanol, acidic corrosive and acetaldehyde.*
***Keyword: TGS gas sensor, Raw milk, Ardunio UNO, Node MCU, Adafruit server, Real time***

## I. INTRODUCTION

Smart city takes an activity for recognizable proof of various new advancements which will help for taking care of the issues confronted by native. The estimation of centralization of microbes is vital issue in various system like observing framework and sustenance evaluation. Raw milk analysis is very necessary because an earlier study shows that raw milk having pathogenic organism that will results an increases in diseases and degrade the quality of life. The milk is requirement of human as most of Indians takes milk as a food. Milk is defined as the outcomes of milking process showed in sanitized conditions of healthy cow. It is good source of nutrients such as proteins, vitamins and mineral salts not only for mammals but also for number of microorganism. The necessity of human is milk because it contains calcium and carbohydrates which will provide strength to human body. For the development of urbanization food safety is important. When fresh milk obtained from healthy cow then it contains fewer amounts of bacteria it will submitted to dairy farm and after that the dairy farm will mix-up with other milk so amount of bacteria will be increased. And also increases harmfulness of milk that affects human health. As we know that bacterial growth leads to the spoilage of milk with heavy production of off flavors which severely affects the milk quality. Generally people used cessation date to decide that milk is spoilage or not. In other way dairy industries uses Infrared Spectroscopy that provide biochemical information related to molecular interaction in between cells and tissues. Pasteurization process is nothing that heating milk at high temperature and then sweep to cooling state. Basically pasteurization process is used in drinks and food industries. It is observed that head space of milk from the cow bearing genetic defect contains ethanol hence VOC's responsible flavor, quality of raw milk can be identified. So finding this type of microbial activities at the real time can be implemented as a part of smart city with IOT architecture.

In propose system, we are going to present real time monitoring system, a tool which allows recognizing concentration of different gases in the raw milk. Stored raw milk contain bacteria that result in unwanted smell, taste etc. With the help of Ardunio and other sensors, we are going to notice the bacteria or microbial in a raw milk and our idea is to publish these results on network. Which will be easily accessible by the customer or client those who want to access this tool using Nodemcu wifi module.

## II. OBJECTIVE

The proposed system is designed with MOS based sensing units for the purpose of real time quality analysis of raw milk products.

The sensors were formulated and calibrated to a various concentrations of volatile organic compounds which were responsible for volatile milk flavors. The proposed prototype is an ARDUINO based monitoring unit which monitors the unwanted ingredients present in the tested milk. Earlier analysis of raw milk was carried with highly advanced analytical instruments such as FTIR, UV-visible Spectrometer and mass chromatograph. These Instruments do not provide high portability, feasibility while handling which results in to high costs and creates more complex situation. The results shown by these instruments are with very poor accuracy.

## III. RELATED WORK

The use of sensory panels and laborious analytical chromatographic methods to detect quality changes in food products is characterized by increased capital cost, and requires a significant input of skilful personnel. Therefore, early and rapid qualitative analysis of food spoilage and dairy products in particular, where product shelf-life is short, might be of significant benefit in industrial situations. Electronic nose systems might offer a number of advantages as they require less technical skills, lower capital cost of the operating system and the use of automated artificial intelligence software to utilize a vast bank of time series spoilage qualitative pattern recognition.

Microbial milk spoilage can severely affect industrial quality process and commercial success of dairy products due to undesirable off-odours, physical defects and secondary metabolite toxicity Important spoilage species include some Gram-negative bacteria such as Psuedomonas uorescens, Pseudomonas fragi and some Gram-positive species such as Bacillus cereus and Staphylococcus aureus . Additionally, acidic conditions in milk fermentation products such as yoghurt and sour milk may favour the growth of some yeasts such as Debaryomyces hansenii, Kluyveromyces spp. and Candida lactis which can also generate undesired off-odours, and loss of texture quality. Conventional cultivation methods and quantification of microbial contamination levels are considered time consuming and not compatible with the industrial requirements of dairy processing industries, efficient quality control and shelf-life evaluation. There is thus an increasing demand for new industrial applications of rapid and inexpensive monitoring systems of spoilage and quality characteristics of food products.

Gas chromatography coupled with mass spectrometry (GC-MS) have been used in previous quantitative studies to detect volatile markers, such as 3-methyl-1-butanol acetaldehyde, acetic acid, acetone, ethanol, propan-2-ol and other alcohols which have been characterised as important spoilage microbial metabolites For example, some bacterial species such as Bacillus cereus, Pseudomonas fragi, Pseudomonas perolens and Bacillus pumilus have been shown to produce 3-methyl-1-butanol, acetyldehyde, acetic acid, ethanol and a range of related alcohols. Despite their deterministic nature, none of these studies have investigated the use of non-linear volatile profiles for early detection of dairy spoilage. Recently, some gas-sensing systems employing arrays of organic or inorganic semiconductors with partial and accompanied by pattern recognition methods have been introduced in the classification of a variety of food-products commercial coffee samples , and even different samples of the same dairy product In the past 3 years some novel gas sensing methods have been carried out such as rapid identification of a group of microbial plate cultures and species , characterisation of class and growth phases of Escherichia coli and Staphylococcus aureus, in liquid cultures , discrimination between a range of xerotolerant and xerophilic mould species and in vitro recognition of important gastrointestinal isolates . However, few studies have so far investigated early detection of spoilage bacteria and yeasts in milk-based media by rapid pattern recognition analysis of non-linear volatile profiles using integrated gas-sensing models

## IV. PROPOSED DESIGN METHODOLOGY

The proposed system consists of various sensors and RF wireless units .The basic units is a Sensory system which is directly exposed to the milk samples from 3cm distance where the responses of each sensors are observed from the milk surface. The TGS Sensors collects data samples from the Spoiled raw milk and this data is processed in the form of gas molecules. If the input data of the gas molecules is in the form of (parts per million) to voltage then by using the heating elements the above data is considered for the further process.

The heating element is heating as per the concentration of the molecules and it depends on the molecules levels to convert vapor gas in the form of voltage.

The voltage values are varying continuously according to the concentration of the spoiled milk where vapour gas molecules are represented with parts per million. The TGS sensors are connected to the ARDUINO which presents the processing of the data values in the form of voltages and it is displayed by using the LCD Module

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*A. Block Diagram*

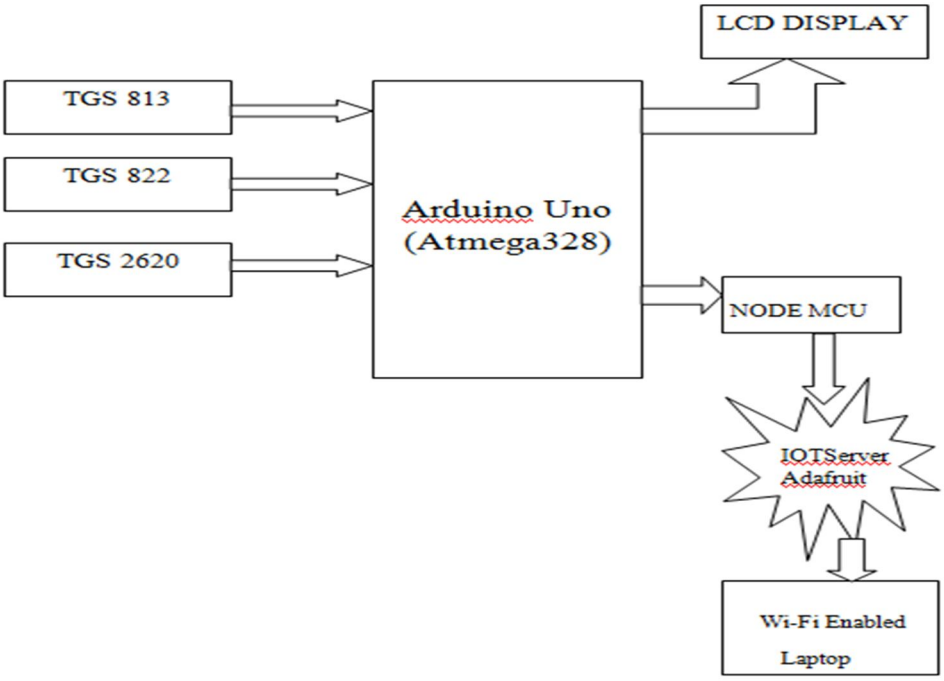


Fig.1: Block Diagram

The maximum voltage is produce at the LCD display the more chemical concentration factors are available in the test milk. The tested raw milk shows the amount of spoilage which is to decide and compare the good raw milk voltage levels with spoilage raw milk voltage levels. If the minimum voltage levels are available the raw milk is good and if the maximum voltage levels are available the raw milk is spoiled. If the maximum voltage levels are available then this is to indicated by the indicators using LED's. The total data can be monitoring in the PC by using the RF Node mcu wifi module where its role is to transfer the data from ARDUINO unit to remote PC by using the peer to peer protocol. The data can be displayed on to the PC terminal window which is achieved by IOT server (Adafruit) tool periodically by data updating of all sensors which can be continuously monitored and recorded in the PC.

## V. RESULTS


Fig .2: Acetal Dehyde is detected by TGS813 sensor


Fig .3: Acetic Acid is detected by TGS822 Sensor

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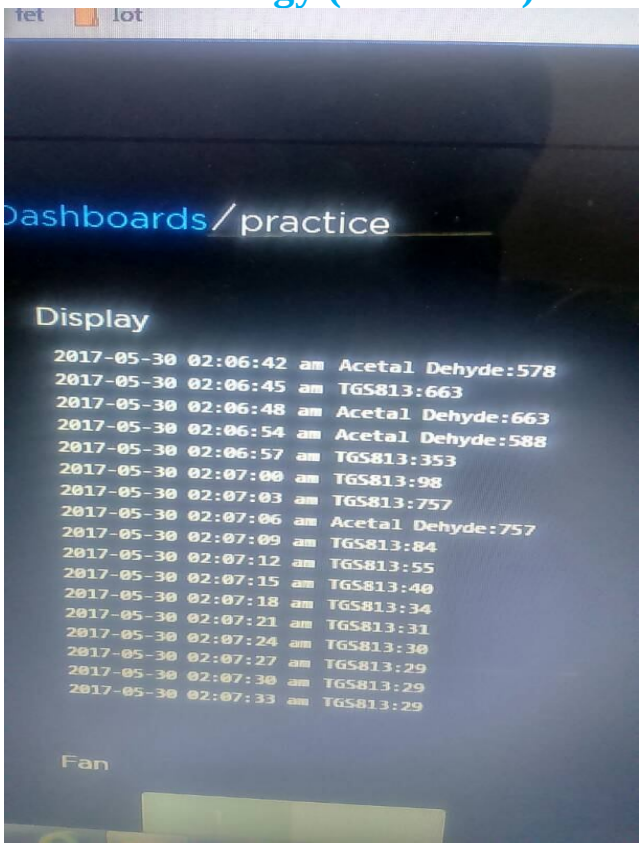

Fig. 4: TGS sensor output on IOT server (Ada fruit)

## VI. CONCLUSION

The raw milk from the healthy cow without adding preservatives is brought from the farm and were exposed directly to senor array from 3CM distance to check how much it is contaminated we are using three different TGS gas sensors and its response was collected in IOT server (Adafruit). In simple it can be said that it is the best suitable model for raw milk quality analysis in real time with low cost and more flexibility. This model is portable and simple to use. It can be easily adapted because as it provides appreciable selectivity and improved response when compared with existing methods.

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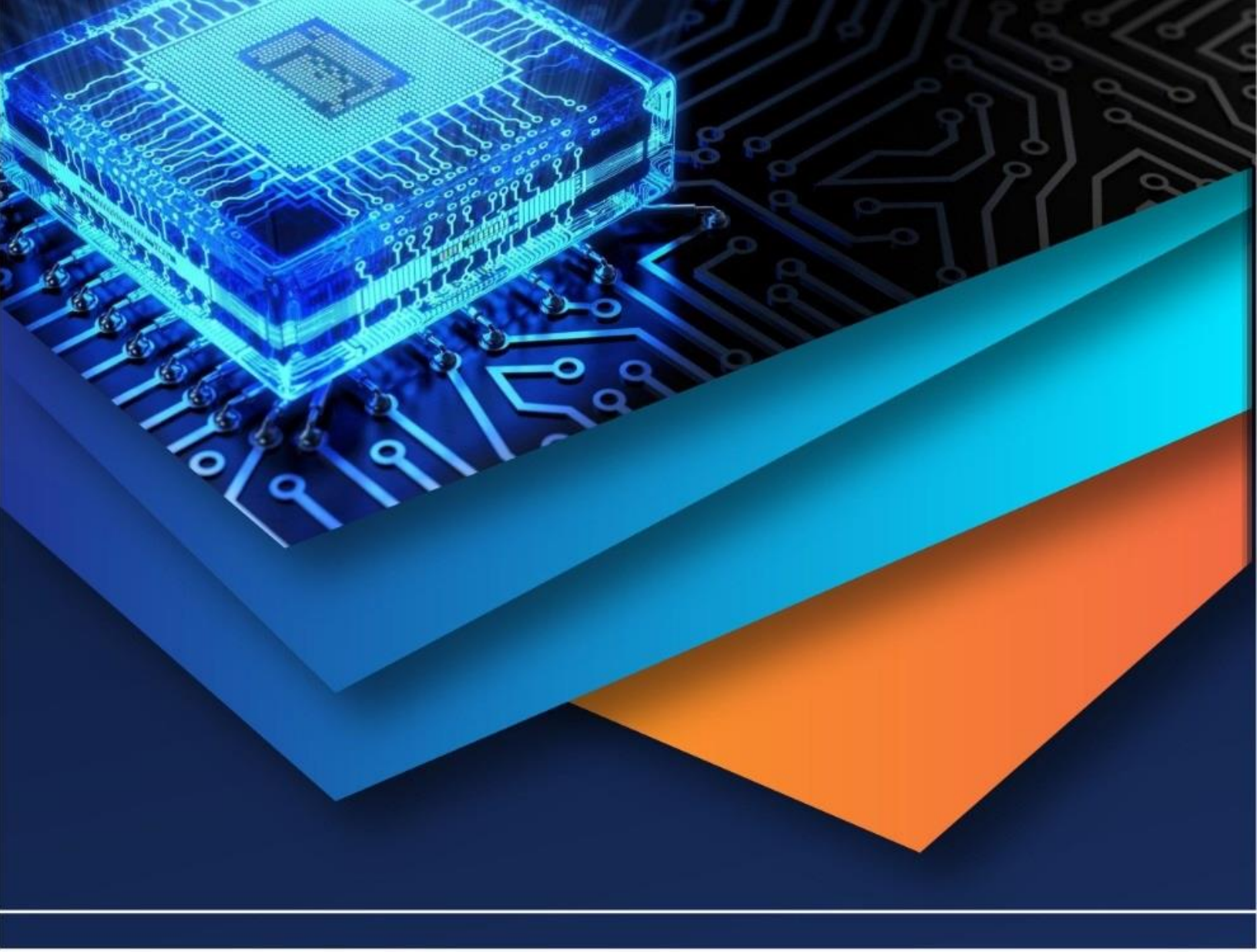

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