Measuring the Waste Water in a Yogurt Production Plant in IOT Environment

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Abstract— Water management is most important factor for any kind of industries and particularly for food related manufacturing industries need it mandatorily. Yogurt is one of the major products in dairy industry and water management in yogurt production is also important. In general yogurt will be filled in a boiler for the process of butter making. Water is the main source utilized by yogurt and it should be properly monitored to avoid wastage of water. In our proposed system the yogurt is filled in the boiler and weight is calculated using load sensor. This load sensor will calculate the weight and according to that water will be added to the boiler and to check overflow of water ultrasonic sensor is used which detects the water level. In our proposed work based on calculated yogurt weight water will be added to the boiler by motor pump and using Ultrasonic sensor level of water in boiler is identified and off the motor pump to avoid water overflow. Through this process water utilization should be properly maintained to avoid water wastage. Similarly all these information are stored in cloud and accessed for future use through IOT module.

Keywords: Yogurt Water Management, Ultrasonic Sensor, Load Sensor, Motor Pump and IOT Module

I. INTRODUCTION

Because each milk product has its own technical line, large changes in effluent quality and quantity are a major issue in dairy facilities [1]. With the commencement of a new cycle in the production process, the composition of dairy effluent changes, impeding the work of in-factory wastewater treatment facilities. Furthermore, time-dependent intense effluent volumetric changes are prevalent. Washing the equipment and flooring as the final step in every production cycle results in daily and hourly variations. Seasonal differences are due to a larger dairy plant load in the summer compared to the winter.

Water foot printing is gaining popularity in tandem with carbon foot printing, owing to a growing awareness that freshwater has become a scarce and overexploited natural resource in many parts of the world, posing a threat of widespread irreversible environmental change and negative impacts on human well-being [2]. The water footprint is a measurement of humanity's use of fresh water in terms of the amount of water used and/or contaminated. The quantity of local water resources needed to generate products and services inside the country is referred to as the water footprint of production.

Yoghurt is a popular fermented semi-finished food prepared from homogenised milk and a combination of yoghurt culture organisms. Set and stirred yoghurt are the two most common forms. In reality, the two processes are similar in that they both include incubation and fermentation. Set yoghurt ferments in retail cups and is stirred fermented before being packaged in the tank; consequently, in this study, we assume a yoghurt plant that produces stirred yoghurt, with water use computed as an average of total daily water usage [2].

Pasteurization is the heat treatment of milk to destroy dangerous germs and render it safe to eat. Pasteurization, which kills dangerous germs, has helped to limit disease transmission. In the manufacture of yoghurt, heat treatment comes after homogenization. Heat treatment reduces the microbial content of milk to acceptable levels for consumers while also causing changes in protein molecules that aid in the development of yoghurt curds and improve their features [3]. The fermentation phase is the most crucial part of the yoghurt-making process. Several bio-physicochemical interactions take place at this stage, leading to the production of the curd and the development of its characteristic flavour and texture [4].

Butter whey wastewater is created during the manufacture of butter. Its amount and content vary depending on the type of butter produced, the method used, the type of milk used, and the environment. The addition of extra butter whey and second cheese whey to washing effluents results in butter whey wastewater. Nonetheless, it has a lower contamination level than butter whey. It is necessary to consider the additional wastewater pollution caused by cleaning solutions, additives, and other materials that enter the drainage pipes.

II. LITERATURE SURVEY

Azza A. Mostafa (2013), The first is a physicochemical method of coagulation-flocculation using aluminium sulphate as a coagulant and sodium alginate as a hairy; the second is a physicochemical method of coagulation-flocculation using aluminium sulphate as a coagulant and sodium alginate as a hairy. The second method uses immobilised Candida albicans and Bacillus subtilis in an organic therapy. The physicochemical treatment of coagulation flocculation reduced 87.5 percent of compound oxygen interest, fluorine (21.9 percent), enlarged chlorine focus (11.3 percent), phosphate (9.91 percent), and sulphate (9.91 percent) (75 percent). The total sugar, total fat, and total protein composition were all reduced by 80, 53.3, and 57.2 percent, respectively. The natural treatment reduced all of the concentrated on boundaries significantly; the synthetic oxygen interest (COD) was reduced by up to 50 and 75 percent using Candida albicans immobilised in sawdust and sodium alginate after 20 and 15 days, respectively, while Bacillus subtilis immobilised in sawdust and sodium alginate showed reductions of up to 87.5 and 75 percent after 20 days [5].

B G Ridoutt et.al (2010), portrays water impressions are arising as a significant supportability marker in the horticulture and food areas. Utilizing an as of late evolved life cycle evaluation based strategy that considers neighborhood water pressure where tasks happen, the standardized water impressions of milk items from South Gippsland, one of Australia's significant dairy districts, were 14.4 L/kg of complete milk solids in entire milk (at ranch door) and 15.8 L/kg of all out milk solids in skim milk powder (conveyed to send out objective). These outcomes show the way that dairy items can be delivered with insignificant potential to add to freshwater shortage. In any case, not all dairy creation frameworks are similar and the fluctuation in water impressions among frameworks and items ought to be investigated to get key experiences that will empower the dairy area to limit its weight on freshwater frameworks from destructive water use [6].

Changchun Xu et.al (2014), illustrates that the production and use of goods and services puts a lot of strain on the hydrological cycle. Water impression is a well-known metric for determining an item's or service's immediate and backhanded water usage. Water impressions were measured at the item brand level for three milk items: 180g Yogurt, 250mL Fluid milk, and 400g Skim milk powder (SMP) in this study. The volumetric and stress-weighted findings of the interaction LCA-based water impression approach were discussed, as well as the volumetric and stress-weighted results. Water impact values were compared across various life cycle stages and products, and potential mitigation strategies were proposed to reduce the strain on freshwater systems caused by inefficient water consumption. The outcomes exhibited the appropriateness of water impression as smoothed out pointer for item supportability the executives and avowed the significance of cultivating stage for water impression decrease [7].

William Finnegan et.al (2010), presents the water utilization and direct energy use related with the dairy handling industry in the Republic of Ireland is examined in this paper. The consequences of the review are contrasted and a past Irish review performed, in 2005 and 2009, and an expansion in effectiveness was noticed. The outcomes were likewise contrasted with an Australian manageability study and it was clear that there is potential for enhancements inside the Irish dairy handling industry. The DairyWater project, which this study is a piece of, incorporates an examination task which investigates the chance of water reuse inside dairy handling plants. The consequences of this undertaking might support further developing the water utilization inside the business [8].

III. PROPOSED SYSTEM

Proposed system describes the better way of water management in dairy products manufacturing with current technology sensors. Based on yoghurt filled in the boiler weight is calculated and water is added and to detect overflow of water ultrasonic sensor is utilized. By implementing proposed system unwanted wastage of water is reduced.

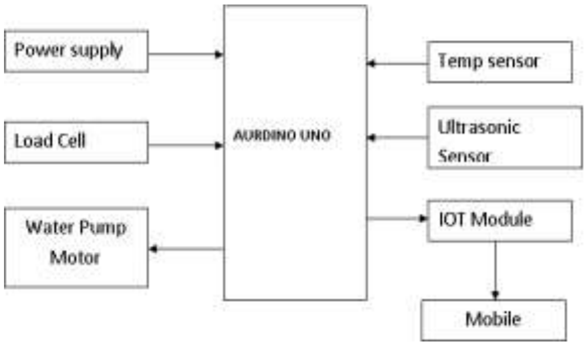
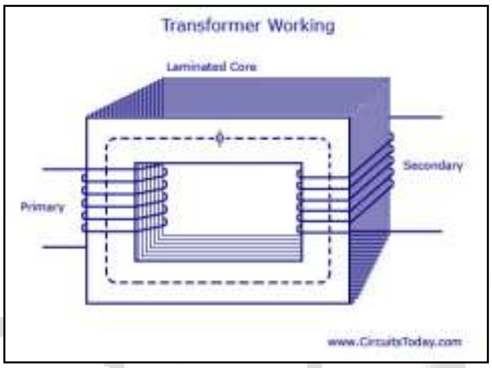


Fig. 1: Proposed system architecture

A. Power Supply:

Mutual inductance between two circuits connected by a shared magnetic flux is the primary basis of functioning of a transformer. A basic transformer is made up of two inductive coils that are electrically distinct yet magnetically coupled by a reluctance channel.



B. IOT Module:

The ESP-12E module on the NodeMCU ESP8266 development board has an ESP8266 chip with a Tensilica Xtensa 32-bit LX106 RISC CPU. This microprocessor runs on a configurable clock frequency of 80MHz to 160MHz and supports RTOS. To store data and applications, the NodeMCU contains 128 KB of RAM and 4MB of Flash memory. It is perfect for IoT applications because to its high processing power, built-in Wi-Fi / Bluetooth, and Deep Sleep Operating capabilities. A Micro USB connector and VIN pin can be used to power NodeMCU (External Supply Pin). It has interfaces for UART, SPI, and I2C.

C. Load Cell:

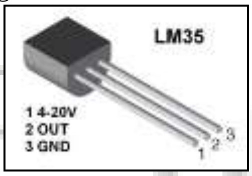
A load cell is a sensor or transducer that transforms an applied load or force into an electrical signal. Depending on the type of load cell and circuitry employed, this electrical signal might be a voltage change, current change, or frequency shift.

D. Ultrasonic Sensor

The ultrasonic sensor (sometimes referred to as a transducer) works similarly to a radar system. An ultrasonic sensor may transform electrical energy into sound waves and vice versa. The acoustic wave signal is a high-frequency ultrasonic wave that travels at a frequency of more than 18kHz. The HC SR04 ultrasonic sensor produces ultrasonic waves at a frequency of 40kHz.

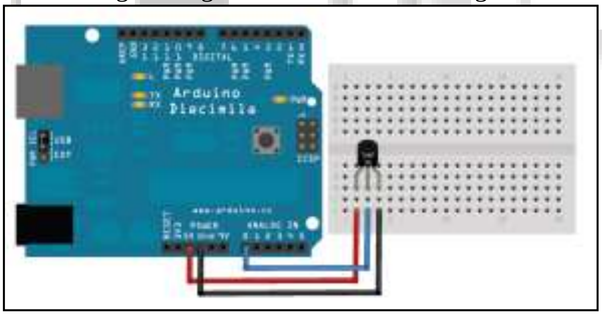
E. LM35 (Temperature Sensor):

The LM35 is an analogue, linear temperature sensor having a linear output voltage that changes with temperature. National Semiconductor's LM35 is a three-terminal linear temperature sensor. It can detect temperatures ranging from -55 to +150 degrees Celsius. The LM35's voltage output increases by 10 millivolts for every degree Celsius as the temperature rises. The LM35 may be powered by a 5V source and consumes less than 60uA in standby mode. The pinout of the LM35 is depicted in the diagram below.



F. Interfacing with Arduino

LM35, being an analog sensor, can easily be interfaced with Arduino using Analog Pin A0 as shown in image.



The LM35 is a temperature sensor that produces a proportional analogue response to the current temperature. The output voltage may be simply translated into a Celsius temperature value. The benefit of the lm35 over the thermistor is that it does not need to be calibrated externally. It's also protected against self-heating thanks to the covering.

IV. CONCLUSION

Water is main resource utilized by various industries and mandatory one for human beings. Large amount of water has been consumed by large number of manufacturing companies and maximum amount of water gets wasted during manufacturing process. In our proposed work food manufacturing (dairy product) industry is concentrated and water wastage has been managed using sensors. Initially yoghurt will be filled in a tank and water is added to produce butter and water plays major in the process of conversion of yoghurt into dairy products. With respect to the weight calculated by load sensor water will be added to the tank through motor pump once threshold limit is identified by ultrasonic sensor motor will be stopped. Then manufacturing process will get started which reduced maximum amount of water wastage in dairy industry and these information are stored in cloud through IOT module.

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