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Detection of Mastitis and Monitoring Milk Parameters from a Remote Location

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Abstract: ***Global milk production shows a positive trend and milk production increased greatly in recent years. In India also milk production has increased substantially as it gives profit to both farmers and dairy farms. For the cost efficiency, accuracy and easiness in monitoring milk production as well as the quality of the milk, the automation has been introduced recently in this field.***
For the farmers who live away from his farm cattle-shed and the milk is collected by the workers, there is need of a system which can facilitate him to supervise the quality (e.g. FAT),quantity (volume) of milk as well as monitoring the health of cattle. Mastitis is the most common decease in cattle, it affects the health of the cattle and quality of milk. Hence, the current project is to develop the system which consists of the sensors that are able to find out important milk parameters like FAT, volume and state of mastitis in cattle, and creates it's database and gives it's notification through SMS by using GSM MODEM on the owner's mobile who is at another location away from his farm. System sends SMS to owner if the standard of parameters is not met. The system enables the farmer to keep watch on the milk production as well as the health of the cattle on the basis of FAT, volume and mastitis detection.

Keywords: FAT, Volume, SCC-Somatic Cell Count, Mastitis.

I. INTRODUCTION

The automation has been introduced in almost all aspects of life. In India also modern technologies are introduced in agriculture, dairy farms etc. For effective management and to increase the milk production, there is a need of an automated monitoring system which would monitor the quality, quantity and health of the cattle.

Mastitis is a serious problem for milk cattle farming and one of the worst worries for the farmers. Mastitis is an inflammation of the udder. It causes lots of loss to a farmer as it affects severely on health of the cattle and on the quality and quantity of milk. The syndrome takes two stages as clinical mastitis and subclinical mastitis. From which clinical mastitis is characterized by an acute udder inflammation, can be identified by abnormities in the udder such as swelling, heat, redness, hardness or pain. Other indications are in milk such as watery appearance, flakes or clots. In subclinical mastitis a cow does not show any visible signs of infection, so it is hard to the owner to detect subclinical mastitis in cattle. But if mastitis is detected in its early stage then the loss will be less, and it can be cured at earliest avoiding the probable losses.

The farmer can have more profit if FAT, milk quality and quantity is good. Thus, it is advisable for the farmer to have a data base of all readings. The project enable farmer to have a database of all readings and it will facilitate him to check, compare and analyses the milking yield and profit calculations. If the values of readings are not meeting the standard set values then it will send a notification to owner of cattle shed through SMS, thus monitoring and controlling can be done from remote location.

II. BLOCK DIAGRAM AND WORKING

The Fig.2.1 shows a block diagram of proposed system.

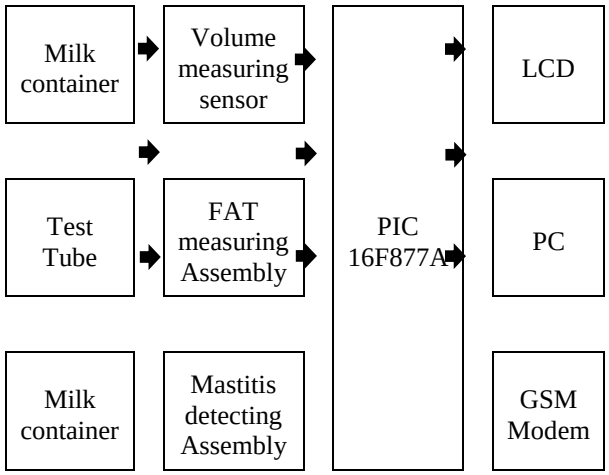

Figure 2.1 Block Diagram of Proposed System

The tasks are divided in following steps

1. Measurement of milk parameters like FAT, VOLUME/WEIGHT & Mastitis detection.
2. Obtaining the notifications on owner's mobile device.
3. Creating the database of all readings including date and time.

2.1 Measurement of Milk Parameters like FAT, Volume & SCC

2.1.1 Measurement of FAT

This milk parameter can be determined by MILKOTESTER [1], VIS-NIR spectrometry with partial least square method (PLS) [2], and low cost short range

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infrared scatter sensors[3]. A milk sample is taken into test tube. High intensity light beam is made to pass through a milk sample present in test tube. On exactly opposite side of the test tube LDR is placed to detect the amount of light scattered by milk sample and the FAT content is found out. The same principle is also used in MILKOTESTER [1]. To ensure the customers nutrition value, government have fixed the range of FAT content for different cattle's, for Cow's milk FAT must be between 3.5% to 4.5% & for Buffalo it is between 6% to 7%. So if milk sample does not satisfy these values, a notification is sent on owners mobile. In this system the LED has given 5V supply then the readings that are taken for calibration purpose of FAT are as follows:

Liquid Samples	Reference Voltages
Milk of 2.1 FAT	1.90V
Milk of 4.0 FAT	1.75V
Milk of 6.4 FAT	1.65V
Milk of 7.8 FAT	1.55V

Table 2.1.1 Calibration of FAT of milk

2.1.2. Detection of Mastitis

Mastitis disease in cattle causes considerable loss to cattleman because of lesser milk quality as well as quantity. So its early detection is required. Dairy industry has set up certain thresholds for checking the heath of the cattle on the basis of SCC present in the milk. Cattles with SCC measurement under 200000 SCC/ml of milk are considered healthy, and cattle's whose milk contains SCC more than 200000 SCC/ml are considered to be infected by mastitis [4]. So SCC is very important parameter to be checked out for analyzing the health of the cattle. SCC can be measured by measured by electrical permittivity method [5], low cost sensor system using Bioluminescence analysis [4] & Electrical conductivity sensor system [6]. Also it can be measured by California Mastitis Test (CMT), Direct Optical Microscopy (DOM). On-line electrical conductivity (EC) measurements have recently been introduced commercially with the goals of predicting mastitis and adulteration of the milk. Mastitis causes changes in the EC of milk, by damaging the mammary epithelium, and thus altering the balance of sodium, potassium and chloride ions. If the cow suffers from mastitis, the concentration of Na+ and Cl^- in the milk increases and the concentration of K+ decreases, which leads to increase EC of milk. On the other hand, if the milk is adulterated with water, the EC is being changed because the quantity of ions decreases so the resistance is higher. In summary, measurement of changes in milk conductivity has been used in many ways. The electrical conductivity sensor was elaborated with a pair of electrodes and an amplification stage.

In current project a conductivity sensor is used for measuring conductivity of milk, depending on which it analyses the quality of milk according to output voltage the conductivity is calibrated and three levels are determined namely Normal, Caution and Warning. "Normal" is displayed for healthy milk. "Caution" is displayed for slightly infected milk that is having subclinical mastitis. "Warning" is displayed for the milk that has severe clinical mastitis. If a cattle is infected by mastitis the Na^+ and Cl^- ions are increased in milk. Due to which the conductivity of milk gets increased. Here cell constant is kept as 1.0 for measurement, it measure conductivity in range of 0.9mS to 19.99mS.

Figure 2.2 Sensor to Measure the Conductivity of Milk

Output voltage of Conductivity Sensor (v)	Different Levels osf Mastitis
3.5V-5V	Normal
2.5V-3.5V	Caution
0V-2.5V	Warning

Table 2.1.2 Calibration for Mastitis Detection

Thus for 1 mS this circuit gives 5V output while for conductivity 10mS it gives 0v at its output this is used as input to ADC of pic microcontroller.

2.1.3. Measurement of Volume

A level detector sensor is used in this project for measurement of volume and calibrated against the output voltage given by it according to the level detection of

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milk. Volume sensor gives output 0 to 5v range and it is calibrated for the range of 0 to 250ml of milk.

Output voltage of volume sensor(v)	Amount of volume of milk (ml)
1V	50ml
2V	100ml
3V	150ml
4V	200ml
5V	250ml

Table.5.2 Calibration for Volume of Milk

2.1.4. Obtaining Notification on Owner's Mobile Device

A low cost microcontroller and GSM MODEM can be used for remote monitoring and controlling the different parameters. The remote monitoring system which will keep a track of the current status of appliances by locally (LAN) or remotely (Internet) to manage, monitor and control the appliances as well as send an alert SMS via GSM network automatically, on owners mobile devise if the conditions are not satisfied. The concerned authority can control the system through his mobile phone by sending commands to GSM MODEM [7]. After measuring all required parameters PIC controller will compares them with the standard parameter values set in it and creates a data base of obtained readings. If any one of all parameters are not satisfying the standard quality parameter values then it will send SMS on owner's mobile device. Interfaced GSM modem can used for the same. GSM modem can be interfaced to PIC controller. GSM is an open, non-proprietary system that is having international roaming capability. GSM satellite roaming has extended service access to areas where terrestrial coverage is not available. Thus, owner may be at any remote location, he will get the notification of the milk parameters daily. It will facilitate him to effective and economic supervision of the milk parameter and cattle health. On the basis of the same the milk theft (by addition of water) can be mitigated.

III. RESULTS AND DISCUSSION

With the help of this system, owner will be able to calculate volume, fat and mastitis level of milk. The parameters are displayed on LCD, database of all readings is created and an SMS is sent to owner's mobile device containing all the readings. Thus after measuring parameters, the system will display them as follows.

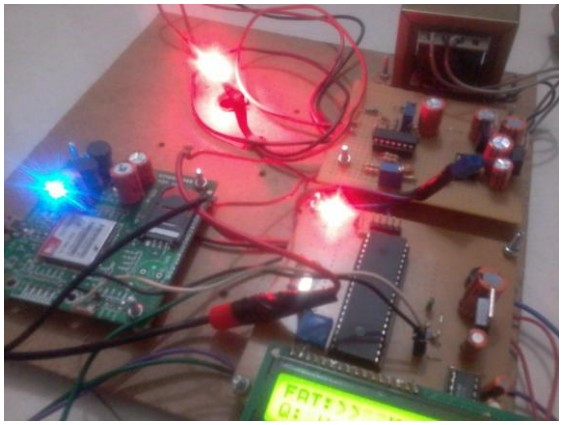

Fig.3.1 Implementation of System

Fig.3.2 Readings of Milk Parameters

Fig. 3.3 Readings of Milk Parameters

	A	B	C	D	E	F
1	Cattle no	Date	Time	Vol (ml)	Fat	Quality
2	1	21-05-2016	13:13:38	335	6.3	Normal
3	2	21-05-2016	13:43:38	331	6.4	Normal
4	3	21-05-2016	14:23:28	339	3.3	Caution
5	4	21-05-2016	14:59:16	321	1.4	Warning
6	5	21-05-2016	15:31:08	351	6.1	Normal
7	6	21-05-2016	15:58:06	390	4.6	Caution
8	7	21-05-2016	16:32:36	364	6.2	Normal
9	8	21-05-2016	16:52:29	225	2.3	Warning
10	9	21-05-2016	17:09:12	240	2.4	Warning
11	10	21-05-2016	17:51:24	230	5.4	Normal
12						

Fig. 3.4 Database Creation of Measured Parameters

A database is created in tabular form containing serial number, date, time, volume, fat and mastitis detection level. Also an SMS will be sent to an owner which will contain all these parameters same will be display on LCD as well.

IV. CONCLUSION

Current project have established a system for monitoring the milk parameters and the health of the cattle from a remote location. The owner gets daily notification through SMS which contains all important information related to FAT, volume, quality factors and Mastitis level of milk along with the condition of the health of the cattle. Thus early stage of illness of the cattle can be easily detected and mitigated which may result in the good milk yield. The system creates a full data base of the each cattle, so that the milk productivity and health can be observed as well as managed properly. Also milk theft can be avoided from remote location due to instant information facility.

V. REFERENCES

[1]. Yadav S.N, Mrs.Kulkarni V.A. ,Gholap S.G (2013), "Design of Milk Analysis Embedded System for Dairy Farmers", IEEE International Conference on Advances in Technology and Engineering (ICATE), ISBN: 978-1-4673-5618-3, Jan. 2013, Paper id 165..

[2]. Carlos Enrique Carleos Artime , Jes's Angel Baro de la Fuente , Miguel Angel Perez Garcia , Rocio Mufniz Vega', Norberto Corral Blanco, (2008), "On-line Estimation of Fresh Milk Composition by means of VIS-NIR Spectrometryand Partial Least Squares Method (PLS)". IEEE-Instrumentation and Measurement Technology Conference Proceedings, 2008. IMTC 2008. ISBN:978-1-4244-1540-3, May 2008, Pages:1471 – 1475.

[3]. Stefano Sabbatucci, Daniel Riordan & Joseph Walsh (2014), "Development of Short-Range Near Infrared Scatter Sensor for the Determination of Fat Content in Homogenised Milk" ISSC 2014 / CIICT 2014, Limerick, June 26-27, IEEE INSPEC Accession Number- 14485293, Pages:30-34.

[4]. Francisco Javier Ferrero Martín, Juan Carlos Campo Rodriguez, Miguel Angel Pérez García, Juan Carlos Álvarez Antón, Cecilio Blanco Viejo, Manuela González Veg &, Juan Carlos Viera Pérez,(2002),"Design of a Low-Cost Sensor System for the Determination of the Number of Somatic Cells in Milk Using Bioluminescence Analysis". IEEE- Trasctions on instrumentation and measurement, Vol. 51. April 2002, ISSN :0018-9456 , Pages :320 – 325

[5]. Gustavo J. Grillo, Miguel A. Perez, Juan C. Anton, F. Javier Ferrero(2002), "Electrical Permittivity Based Sensor to Evaluate Fresh-Milk Somatic Cell Concentration (SCC)" IEEE Sensors Journal (2002)-Vol.1,ISBN 0-7803-7454-1, Pages: 217 – 220.

[6]. Luz M. Alonso V., Arturo Minor M.(2006),"Design and Construction of a System for Measuring the Concentration of Water in Milk". IEEE-Proceedings of the Electronics, Robotics and Automotive Mechanics Conference-vol.2,sept 2006, ISBN:0-7695-2569-5, Pages:47-51.

[7]. Sahani, M Kumar Rout, Mandal, A.(2014),"Remote monitoring in home automation using low cost microcontroller",IEEE International Conference on Communications and Signal Processing (ICCSP) 2014, ISBN:978-1-4799-3357-0, Pages:925 – 929.