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HEALTH MONITORING SYSTEM OF CATTLE AND ELECTRONIC MILK TESTING EQUIPMENT

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ABSTRACT

Milk production is increasing substantially over the recent years in India. Here in this paper, we discuss the methodology to obtain information symmetrical to the market. Hence, reducing the problems of tedious works. Agriculture is one of the major source of incomes in India and specifically the rural areas. Animal products of animals like cow, buffalo sheep etcetera becomes the income source of rural people and hence, Animal husbandry becomes an issue of concern. It is important for farmers to understand and utilize technology to increase productivity and reduce man power over looking after the animals. In this paper, we discuss a system to use wireless communication system for animal husbandry. The sensors are mounted on the body of the cattle and depending upon the readings obtained by these sensors health stability of the cattle can be monitored. So by maintaining the proper health conditions of the cattle, productivity can be increased. Testing of milk parameters also has a great importance in dairy farming. In this system, parameters like FAT, SNF, pH value are included. Sensors like pH sensor, Lactometer and ultrasonic sensors are used to test the above mentioned parameters.

Keywords: *Wireless sensor network (WSN), Correct lactometer reading (CLR), Solid not fat (SNF), FAT.*

I. INTRODUCTION

A. Overview

Farmers are the primary providers of milk for dairy farming. But this milk is raw and also unprocessed. The milk dairy collects raw and unprocessed milk from multiple collecting points situated in rural areas on daily basis. If at any of these collecting points, the milk is not consumable i.e. if the parameters of the milk is not as per the requirements or the milk is spoiled and is not known while collecting, the bacteria in that milk will affect gallons of milk mixed with it. So it is necessary to test the quality of milk before any processing. Here we discuss a method to test the quality [2] and also to reduce man power. The system effectively checks quality of raw milk at the collection point and provide real time result on the database [2][7]. Quality of the mainly depends on the health of the cattle.

Production of the milk reduces due the health issue. So, we are designing a system for monitoring the diseases of the cattle like milk fever, metritis, ketosis [5][9] etc. using the different sensors.

B. Advantages of Cattle Health Monitoring System and Electronic Milk Testing Equipment.

- Milk parameter measurement:
- User friendly with only single push button for testing.
- Readings are obtained very faster and reading will be accurate.
- Simple hygienic measures.
- Easy installation.
- Health monitoring system:
- Production of milk can be increased depending upon the measures taken by using monitoring system.
- Dairy farming will be smarter and cashless.

II. SYSTEM ANALYSIS

A. Limitations of Existing system:

In the existing system, there is no usage of wireless sensor for monitoring the health status of the cattle[3] and no method is used to alert the farmer about the health status of the cattle. In the present scenario, the usage of the electronic milk testing is very less. The system with low cost and low power consumption milk testing scheme makes the analysis accurate and less compatible[4].

B. Problem Definition

Measurement of different parameter of the milk like pH, CLR, SNF, fat and quantity of the milk using the sensors like pH meter , LDR and ultrasonic sensor respectivel Monitoring the health status of the cattle using sensors like accelerometer, temperature sensor, GPS module to know the location of the cattle and heart rate sensor.

C. Proposed System Features

The work proposed here uses multiple sensors for measuring required parameters like pH, CLR, SNF, fat and quantity of the milk testing. The sensors being used to measure these above mentioned parameters are pH meter (pH value), LDR (Fat), Lactometer (CLR), Ultrasonic sensor (Quantity of milk). Using this information, the purity of the milk can be acquired.

This system contains a transmitter that transmits health status recordings and an identification number that is unique to each module. This monitoring equipment periodically records the animal's core body temperature, leg motion, and absolute position (via GPS), as well as the temperature of the cattle. According to wireless sensor network, ZigBee-compatible centralized nodes will be placed on the cattle. Whenever the animal moves around in the range of the proposed system, the data stored in the microcontroller or the buffer is uploaded to the centralized node which will again transmit to the main base station for better analysis and storage of data. Measurement parameters like the temperature of the body and heart rate can be referred to known trends in circadian rhythm over the entire day. A GPS device can also be used to find out the exact location of the cattle and also to understand the complete behavior of the animal depending upon its health status. These observations also helps to monitor the heart rate fluctuations and any changes in the body temperature.

III. SYSTEM DESIGN AND IMPLEMENTATION

A. Proposed System For Electronic Milk Testing Equipment.

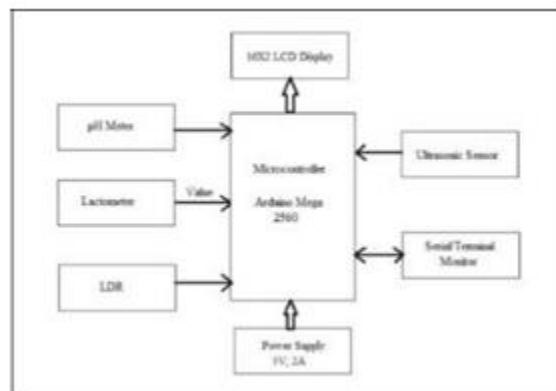


Fig .1. Block diagram of the milk parameter measurement.

A milk parameter measurement system contains an LDR calculate the amount of light un-scattered through the test tube, a pH meter and sensor to sense the pH value of the milk, a ultrasonic sensor to measure the quantity of the delivered to dairy by the farmer.

This system is used to measure the parameters of the milk quality like Fat, SNF, pH, CLR and quantity of the milk using LDR, pH meter, lactometer and ultrasonic sensor respectively. The high intensity light beam is made to pass through the test tube which is enclosed inside the wooden compartment which is used for obtaining the outspreading of light from the test tube. At the bottom side of the test tube an LDR is mounted to obtain the amount of light which is not scattered through the test tube. This will provide the amount of fat content in milk which is directly proportional to the voltage across the LDR. The pH meter is used to obtain the pH value of the milk. The actual value should be 7 for any milk. The pH sensor is connected to the pH meter which gives the value of acidity of milk. Lactometer is used to obtain correct lactometer reading (CLR) of the milk. Using this reading the SNF can be calculated using formula given below:

$$SNF = (CLR \text{ reading}/4) + (Fat * 0.21) + 0.36. \quad (1)$$

The ultrasonic sensor is used to measure the quantity of the milk. An ultrasonic sensor is mounted on the wooden stick and is placed on the top side of the vessel containing milk. The quantity can be obtained by differencing the maximum quantity of the milk with the actual quantity measured and measured value is converted to the liters. All these obtained value is uploaded to the database through the gateway as shown in the figure-1. Table-1 represents the tested values of the milk parameters.

Table-1 Milk parameters

Sl.No	Fat	SNF	CLR
1	2.7	7.4	C25.5
2	4.5	8.4	C27.5
3	3.6	8.5	C29.0
4	4	8.1	C27.0

IV. PROPOSED SYSTEM FOR CATTLE HEALTH MONITORING SYSTEM

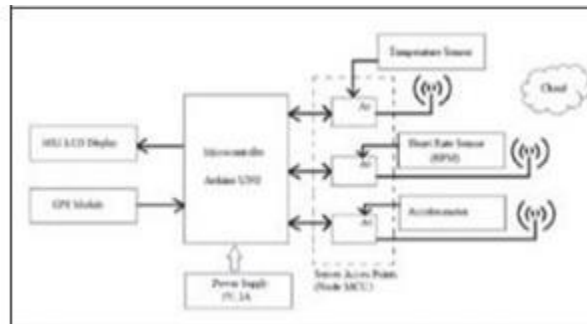


Fig.2. Block diagram of a single sensor node.

A single node sensor system consists of temperature sensor for checking the core body temperature, an accelerometer to calculate the number of steps the cattle takes over a period of time, a GPS to detect the location of the animal and a heart rate sensor to check and monitor the status of the status of the heart pulses.

The module can't be used on a long term as the sensors need timely calibrations and also they must have proper electrical contact with the skin of the livestock. This connectivity needs a conducting gel which may dry out to several factors; also the electrodes may get displaced.

An accelerometer is attached to the limb of the cattle. The sensor is enclosed in a waterproof casing. It provides three axes coordinates that helps to calculate the number of footsteps.

All these above mentioned sensors are interfaced to a microcontroller or a microprocessor. The sensors are programmed according to the reference values of the health status of cattle. The observations of the module is then collected periodically to monitor the health factors. Table-2 represents the reference temperature values of the cattle.

Table-2 Reference Temperature values(In Degree Celsius)

Animal	Normal Temp (Celsius)
Cattle	38.5
Buffalo	38.2
Sheep	39
Goat	39.5
Calf	39.5

V. DISCUSSION AND FUTURE WORK

Discussion

To develop and utilize a system with higher efficiency, accuracy and lower cost for analysis of the parameters of the raw milk. A system to monitor and analyze the behavioral and physical changes of cattle using WSN technology. The system helps in both volumetric and qualitative analysis of the milk parameters (SNF, CLR and pH). As the system is compact, power consumptions is considerably low and also portable.

Results

The data obtained from the health monitoring system module is stored in the cloud to create a data base. The following figures represent the data obtained graphically.



Fig 3. Graphical representation of Temperature sensor in Degree Celsius



Fig 4. Graphical representation of Heart rate sensor in beats per minute



Fig 5. Graphical representation of Motion sensor(Accelerometer)

Future work

The system can be improved in future by increasing the system accuracy. It can also be focused to reduce its size further so that it can be handier. Also the money transactions can be cashless i.e., directly to the accounts of the farmers using the data collected from the milk tester that is stored in the data base.

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