HEALTH MONITORING SYSTEM FOR DAIRY COWS

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Abstract: The health monitoring of dairy cows plays a major role in today's world. By observing the health of cows we can increase the milk yield. Because milk yield is one of the main livelihoods of farmers who have more cows. The number of farms increases day by day because of advanced technology and farm automation. It is too difficult to take care of cows from many cows. Till now there is a monitoring system that only monitors the body temperature, relative humidity, rumination, heart rate of dairy cows. But our proposed system is to monitor the health of cows and predict the milk yields.

Index Terms **– rumination sensor, temperature and humidity sensor, health monitoring, cattle health, monitoring of cattle health, Thing speak, gsm module, milk prediction, milk yield prediction**

I. INTRODUCTION

In developing countries like India, dairy farms contribute a major portion to it. India is one of the largest populated countries, has the largest milk production every year worldwide. Milk is considered one of the main sources of income for farmers. Most of the farmers in India are depending on the earnings from the sale of milk and milk products. If any disease occurred for the cows may affect the livelihood of farmers due to lack of milk sale.

Health monitoring of cows plays a major role nowadays. Milk yield is one of the main sources of income for farmers who have a large number of cows and it plays an important role in building the economy of farmers. There is an existing health monitoring system, but the problems among these are they do not predict the milk yield and the health status of the cow.

There is an existing system, which is not a cost-efficient system. They only sensors for sensing the values for body temperature, relative humidity, rate of rumination, heartbeats per minute only and they only predict the health conditions. And they do not predict the milk yield.

So this paper is to solve the problems associated with the above-mentioned existing system. In this system there is a temperature & humidity sensor, rumination sensor, heart rate sensor, these sensors are connected with atmega328p. The collected sensor values are compared with some standard reference values and transferred to a Node MCU through a serial network and to a GSM Module. And GSM Module transfers the collected data to the farmer's phone. Node MCU connected along with atmega328p transfers all the data to cloud storage named Thing speak, where it is visualized and stored. On this Things peak channel, the received sensor data are analyzed by using a MATLAB tool available itself on a Thing speak, which predicts the milk yield (Liter's /day) of cow and is displayed on the Things peak channel.

II. LITERATURE SURVEY

In recent times, cattle health monitoring had become an increasing concern due to the health problems and decreasing of milk prediction.[1]In this paper, there is a monitoring system by using the health parameters measured by 3 sensors and monitor continuously and notice if any change in health parameters of cattle. This paper functions as an answer that solves the problems associated with each of the previously mentioned systems. The system incorporates a temperature & humidity sensor, a heart rate sensor, and a rumination sensor; these sensors are configured with Atmega328p. The data is first collected through the sensors by standalone Atmega328p and then transmitted to NodeMCU through serial communication. To make NodeMCU work; network connectivity is required, as it consists of the ESP module. All the data from NodeMCU is then transferred to an online platform named Thing Speak where it is visualized on a Thing Speak channel. On this Things peak channel, the received data is analyzed using MATLAB Analysis Tool available on Thing Speak itself. [2] Another existing cattle health monitoring system consists of wearable sensors and Zigbee. Cattle should always remain to be in the proximity of the range of Zigbee. If any cattle exceed the range of Zigbee, then it is difficult to transfer the data to the base stations. This system analyses the data received from sensors such as body temperature, absolute position, heart rate, head motion, and predicting the health condition of the cattle. This system also doesn't predict the milk yield of a cow [3] in this paper, there is a monitoring system health parameters measured by corresponding sensors and controlled by a microcontroller and displayed in a display and the data should be manually collected.

III. BLOCK DIAGRAM OF HEALTH MONITORING SYSTEM FOR COW

The basic block diagram for the cattle health monitoring system is shown in Fig 1

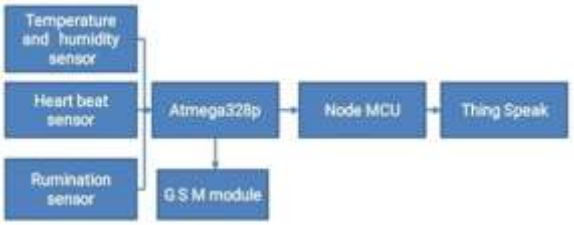

Fig. 1 Basic Block Diagram of Health Monitoring System for cows

This system consists of a temperature & humidity sensor, a rumination sensor, and a heart rate sensor. These sensors are used for the automatic measurement of various health factors. These sensors are mounted on the cow's body, which continuously observes the cattle's health and delivers the output in the form of electrical signals. Then these sensors are connected to atmega328p (microcontroller). This system consists of a GSM Module, Node MCU, and a Thing speak other than the sensors. The signal transmitted by the atmega328p is transferred to the GSM Module & Node MCU. It is built on a Wi-Fi soc named ESP8266. Internet connectivity is required for starting the Node MCU. After that, the signals are transferred to thing speak and there predict the milk yield

1) Transmission of data from sensors

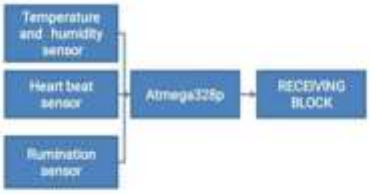

Fig. 2 Block Diagram of transmission part

The transmission block diagram for the cattle health monitoring system is shown in Fig 2. The sensors mentioned above are connected to the analog pins of the microcontroller (Atmega328p). The sensor data is continuously monitored and transmitted the receiver part by the microcontroller for predicting the milk yield.

2) Receiving Of Data From Transmission part

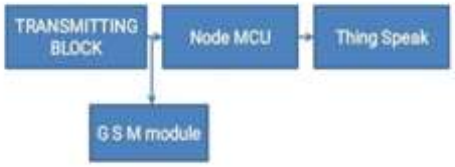

Fig. 3 Block Diagram of Receiving part

The receiving block for the cattle health monitoring system is shown in Fig 3. The temperature, humidity, heart rate, and rumination data collected using atmega328p is transmitted to GSM Module & Thing speak via serial communication. Here the serial communication used is UART (Universal Asynchronous Receiver and Transmitter). And this data is then transmitted to the Thing speak channel for storing and visualized in the form of graphs and histograms. Then this data sent to the MATLAB Analysis tool for predicting the milk yield by using a pre-build machine learning system.

IV. CIRCUIT DIAGRAM

The circuit diagram of the proposed system is shown in fig4.

Fig. 4circuit diagram of the health monitoring system for cow

This circuit consists of a temperature &humidity sensor, rumination sensor, heart rate sensor, microcontroller (Atmega328p), GSM Module, Node MCU (ESP8366), and a think speak. Those 3 sensors are connected to the analogue pins of the microcontroller for taking the values. After collecting the health parameters it is transferred to the GSM Module & Node MCU connected in the output ports of the microcontroller. And after the Node MCU, there is a lot of analytics platform service named thing speak is connected, there the output signals from the sensors are stored and visualized in the form of graphs & histogram

V.COMPONENTS

1) Temperature &humidity sensor

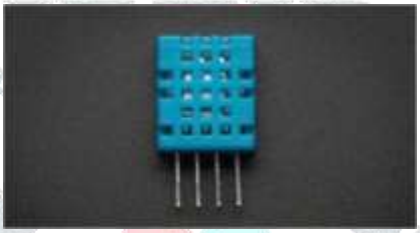

Fig 5 DHT11 Sensor

The temperature &humidity sensor used here is DHT11. This sensor (DHT11) is connected to the first analog pin of atmega328p and by using a serial communication fed to the Node MCU. The standard body temperature of a cow is between 36.5°C and 39.5°C. If the body temperature of cow is below the normal value the milk yield decreases rapidly 5-6 liters per day and the cattle's may suffer some diseases like milk fever, indigestion, and poisoning and if the body temperature above the normal value causes anthrax, foot &mouth disease, etc. The standard relative humidity in the room is between 58% and 65%. When the humidity above the normal value it depends on the milk yield. i.e.; milk yield decreased 3-5 liters' a day

2) Heart rate sensor

Fig.6 KG 011

The heart rate sensor used here is KG011. This sensor will also detect stress and animal anxiety. This sensor is kept behind the cow's elbow to listen over the left side of the cow's chest. The standard heartbeat of adult cattle is between48 and 84BPM (Beats Per Minute). At that time the cow is mostly healthy and provides maximum milk. When the heartbeat above 84 BPM will cause a rapid change in the production of milk. i.e.; milk drops 4-6 liters per

3) Rumination sensor

Fig.7 ADXL345

The rumination sensor used here is ADXL345. It is a 3 axis gyro meter. It produces the static acceleration of gravity and dynamic acceleration resultant. It is a 3 axis gyro accelerometer but we seeing only two axis (x&y directions), the rumination rate is measured

generally a cow ruminates 400-500 times a day, 20-22 times in a single hour. When the rumination rate is below the standard value it will affect the production of milk. So it makes the drop of 15% -30% of milk is observed

VI.PLACEMENT OF SENSORS

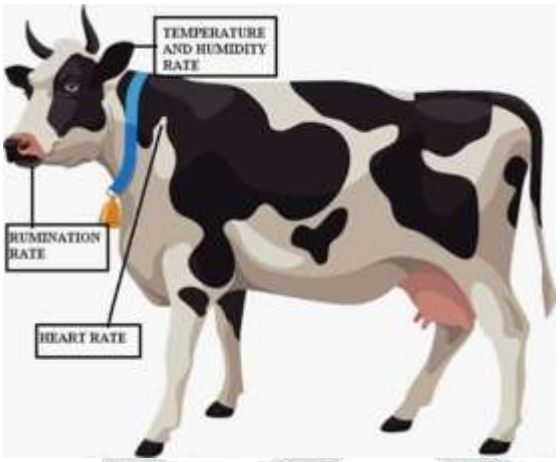

Fig.8 Placement of sensors

The DHT11 sensor used to measure the temperature and humidity parameters of the cow is placed in the ear of the cow. The second sensor i.e.; the rumination sensor (ADXL345) is placed near to the jaw of the cow to track the chewing movement while eating. And the third sensor i.e.; the heart rate sensor is placed behind the cow's elbow to listen over the left side of the cow's chest. These placements were determined by consulting a veterinary doctor

VII.SIMULATION AND RESULT

In our proposed system there we consider four health parameters in the cow. They are temperature, humidity, rumination, heart rate. Graphs and histograms for these corresponding parameters can be visualized in Thing speak. We visited a farm in chirakkara and monitor the health parameters of two cows for two weeks. By using that obtained reading we found out some results.
The temperature and humidity data from the DHT11 are shown in Fig 8 and Fig 9

Fig.9 Temperature data visualized in Thing speak

The graph plotted above is by using the temperature data obtained by monitoring a cow. By observing that data we got references that is the standard value of the temperature of a cow is in between 36.5°C and 39.5°C.

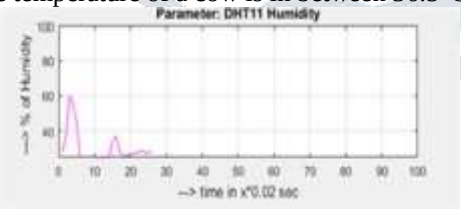

Fig.10 Humidity data visualized in Thing speak

The figure shown above is the graph visualization obtained from the Thing speak channel for humidity data. After monitoring a cow we get some references that are the standard relative humidity of the room is between 58% and 65%.

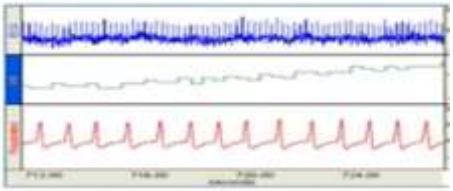

Fig.11 Heart rate data visualized in Thing speak

VIII.CONCLUSION

By using our proposed system, the health parameters of cows can be tracked every minute. In this, we predict the milk yields and any abnormality in health parameters like temperature, humidity, heart rate, rumination rate can distinguish. Here the components used are low cost hence the system is cost-efficient. In this, it can be visualized and stored thus, our proposed system is proved as self-dependent with minimum user interference, and it is continuously observed suitably

IX.FUTURE SCOPE

This cattle health monitoring system consisting of all sensors is made for future developments. This device should be easy to load and remove. This device is more accurate while predicting the milk and it is compact and comfortable for the cow. More powerful and accurate sensors are used here. For higher accuracy largest datasets can be used. Also, the current system is wired it can be modified to wireless and can be used in multiple cows at a time.

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