Cattle Health and Environment Monitoring System

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Abstract - *Human can't imagine their life without technology in this modern era. Various kinds of technologies help people to live their life with luxury. The cattle industry is an integral part of the world economy. Additional benefits can be realized from this class of technology, such as the ability to identify the presence of disease early and thereby prevent its spread. The IOT based cattle health and environment monitoring system monitors various cattle health parameters such as body temperature, heartbeat, location of animals and environmental parameters such as temperature, humidity. In this system Arduino UNO microcontroller is used to sense the various health and environmental parameters. If any of the monitored values is abnormal, notification is sent through GSM to the farmer. The results of the proposed system can be stored in cloud and viewed in internet on interfacing ESP8266 Wi-Fi module. It can also be viewed in mobile by using IOT thing speak monitor widget .Farmers may increase production through this arrangement and execute appropriate control strategies for farm process.*

***Key Words*: Arduino UNO, ESP8266 Wi-Fi module, IOT, IOT thingspeak monitor widget, GSM**

1. INTRODUCTION

Agriculture is the major source of income in the country sides. Cattle industry is an integral of world economy. Animals like cow, buffalo, sheep, goat etc play in an important role in life of rural. Animals in the farm are being affected by various kinds of diseases and farmers are suffering heavily. To avoid such things, we propose a health monitoring system to track individual animal movement as well as to monitor occurrence of diseases.

Sensors are being mounted on the cattle to monitor the body temperature and heart beat of each animal. Normal body temperature of cattle is 38.5'C to 39.5'C.Normal heart beat of a cattle is 48 to 84 beats per minute. If it is below or above this value, it is notified to the farmer via SMS through GSM. It is difficult for the farmers to locate the cattle if it goes out of the farm. So, in order to overcome this location of each animal is being monitored using GPS and notification is sent to the famer when it reaches the boundary of the farm.

The temperature and humidity of the farm also affect the health of the cattle to a greater extent. So to prevent this, temperature and humidity of the farm is also monitored continuously. In this system the Arduino UNO receives the data from the sensors and develops the content accordingly. The ESP8266 Wi-Fi module will transfer the data internet so that cattle can be monitored from outside the farm.

2. LITERATURE SURVEY

Previous Literatures and research work done by scholars in this domain are reviewed. Difficulties faced the by farmer to identify the abnormal situation of cattle is presented here.

The cattle are affected by various kinds of diseases. These diseases can be identified[1] through use of non-invasive, low cost, sensor technology .These diseases can been mapped to specific aspects of animal behavior that have been mapped to the sensors which are most significant to identify these diseases. This helps the farmers to monitor the activity of cattle and interpret whether it is affected by any disease if there are changes in the sensor data.

The farmers find it difficult to take the cattle to doctors when it is affected by diseases. Sometimes the doctors may not be available in hospitals. In those cases various health parameters such as body temperature and heart beat can be sensed and a graph [2] can be sent to the doctors using ESP8266 Wi-Fi module. So by observing this graph doctor can tell about the animal health.

Seasonal and environmental changes can influence the health of the cattle to a greater extent. Exposure of cattle to hot environment produces reduction in the rates of feed intake and productivity .Hence the environment temperature and humidity [3] has to be monitored in order to maintain the health of the cattle.

3. SYSTEM ANALYSIS

The listed literatures give us the basic understanding of concepts and help us to design the new system of monitoring the health parameters of cattle by overcoming the various drawbacks in the existing system.

3.1. Drawbacks in the existing system

3.1.1   Location of the cattle is not monitored

The existing system does not provide features to find out the location of animals in the farm. If the size of the farm is huge and if the cow is affected by any kind of diseases then it might not be able to move from the location, in these situations tracking the animal location becomes very important.

3.1.2   Farmers are unaware when the cattle are affected by disease

The cattle are affected by various kinds of diseases. Since notification is not sent to the farmers when there is abnormal change in the health of the cattle, they are not aware when it is affected by any kind of disease. So the farmers are not able to treat the cattle at the correct time which may lead to the severity of diseases.

3.1.3   Time consuming

The existing system is time consuming. Since the farmers have to go in person to check whether the animal is affected by any kind of disease this requires more time when compared to the automated system.

3.2. Proposed system

In this proposed system in order to monitor the health of cattle we measure two of the major health parameters which are body temperature and heart beat. The arduino UNO microcontroller is used to gather data from the sensors. The body temperature and heart beat of the cattle increases when it is affected by any disease. When the temperature increases the GSM is used to notify the farmer with SMS. The environment condition of the farm also plays a major role in maintain the cattle's health. So when there is increase in the environment temperature or humidity it is being sent as SMS to the farmer. In huge farms or when the cattle are affected by disease it is difficult to track the location of the cow. GPS is used to track the location of animals in the farm. The data from the temperature and heart beat sensor is transferred by the ESP8266 Wi-Fi module to the internet where it can be viewed graphically from outside the farm. The proposed system can also be used for industrial purposes where there are huge numbers of animals and it may be difficult to monitor the movement of each individual animal. In those cases the system proposed here can be designed as a small IoT device which consists of all the sensors and may be fixed to the animals. This reduces the cost and makes it feasible for the industries.

4.   SYSTEM DESCRIPTION

The description of the proposed system is explained with architecture diagram and module explanation.

4.1 System architecture
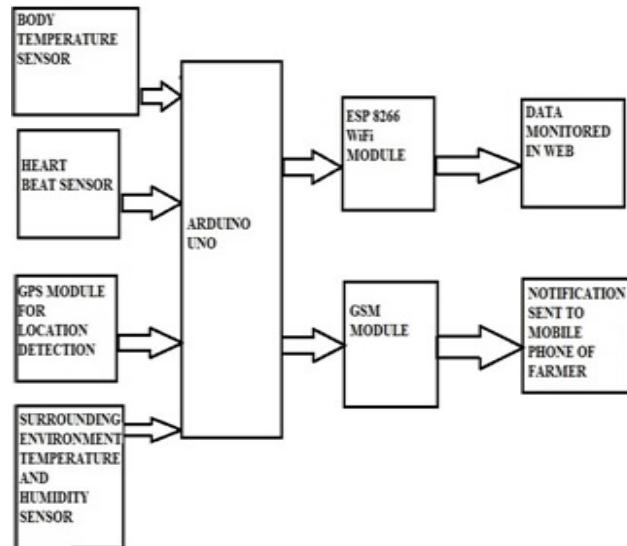
Fig-1: Architecture diagram

The various types of sensors such as thermistor, heart beat sensor and GPS are being fitted to the cattle. The normal body temperature of cattle is 38.5'C to 39.5'C and normal heart beat rate of a cattle is 48 to 84 beats per minute.

The environmental temperature and humidity also affect the health of the cattle to a greater extent. If the temperature is high it may reduce the rate of feed intake as well as production of milk. The DHT 11 sensor which is used to measure the farm temperature and humidity of the environment is kept in any part of the farm.

The arduino UNO is utilized to collect various health parameters such as body temperature, heartbeat, location of animals and environmental parameters such as temperature. When these collected values goes beyond the threshold value then GSM module is used to send SMS to the mobile phone of the farmer.

The arduino UNO transfers the sensor values through ESP 8266 Wi-Fi module to the internet. The data is represented in graphical format which can be helpful for farmers to easily understand the heath of the cattle.

The health parameters can also be monitored in mobile by using a widget called IOT thingspeak monitor widget. This widget displays the values in the home screen of the mobile as well as in graphical format which helps the farmers and doctors to easily monitor the health of the cattle.

4.2 Module description

4.2.1 Arduino UNO

Arduino is an open source computer hardware that is used to sense and control objects in the physical world. The Arduino UNO is a microcontroller board is based on ATmega328.It has 14 digital input/output pins, 6 analog inputs, USB connection, power jack and a reset button. The Arduino UNO is used because of their flexibility, simple programming, and low cost, huge collection of application data and large availability of open source developer tool.

Fig-2: Arduino UNO

4.2.2 Body temperature sensor

The thermistor is used to sense the body temperature of the cattle.They are classified into NTC and PTC based on the way they respond to temperature changes.NTC thermistors are most commonly used to measure body temperature. The usual cattle temperature is 38.5-39.5 Celsius. The diseases related with body temperature are milk fever, poisoning, indigestion, influenza and foot and mouth disease. So it is essential to measure body temperature.

4.2.3 Heart Beat sensor

The heart beat sensor counts number of heart beats in a minute. It contains IR pair which detects heart beat from blood flow. Both IR transmitter and receiver have to place in straight line in order to measure the heart beat rate accurately. Cattle have heart beat in the range of 48-84 beats per minute. If the heart beat is beyond this value it indicates stress or animal anxiety.

4.2.4 DHT 11 sensor

The environmental conditions of the farms also play a great role in cows being affected by various kinds of diseases. In this system the environmental temperature and humidity of the farm is monitored by DHT 11 sensor. The DHT 11 temperature and humidity sensor features a temperature and humidity sensor complex with a calibrated digital signal output. When there is a drastic increase in temperature or humidity, the farmer is being notified with an SMS.
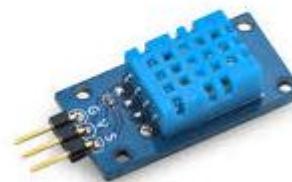
Fig-3: DHT11 sensor

4.2.5 GPS

When there are large number of cows or when the size of the farm is big it is difficult to track the location of animals. So each animal is fitted with a GPS which helps to track the location of the cows.GPS provides satellite signal that can be processed in GPS receiver. The satellites emit radio signal of short pulses that are sent to GPS receivers.The receiver compute position , velocity and time .They can calculate the position within 100 meters and continuously update their position more than once a second.

4.2.6 GSM

A GSM module is a specialized type of modem which accepts a SIM card and operates over a subscription to mobile operator, just like mobile phone. The GSM modem is used to send SMS when connected to the arduino.If the values are beyond the threshold value GSM sends a notification to mobile phone. The farmer can identify abnormalities of the farm with the help this notification.

4.2.7 ESP8266 Wi-Fi module

The continuously sensed data from thermistor and heart beat sensors are transferred by the ESP 8266 Wi-Fi module to the web. The ESP8266 is a small module which allows microcontrollers to connect to Wi-Fi network and make simple TCP/IP connections. Here in this system thing speak an open source Internet of Things (IoT) application and API is used to represent the data graphically in web. This helps the farmers and doctors to monitor the cattle from anywhere outside the farm
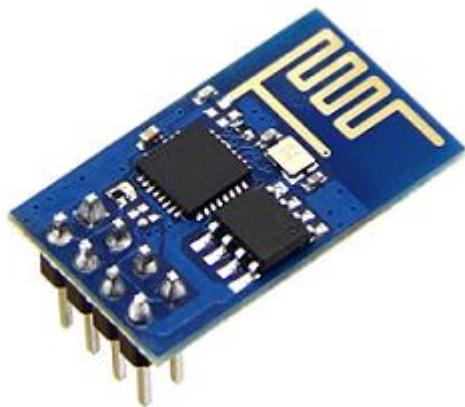
Fig-4: ESP8266 Wi-Fi module

4.2.8 Health monitoring widget

The IOT thingspeak monitor widget is used to monitor the health parameters such as body temperature and heart beat of the cattle. The widget displays the values in the home screen of the mobile as well as in graphical format so that it is easily understandable. It displays the graph in hourly, daily, weekly and monthly basis which helps the doctors and farmers to predict during which period the health of the cattle have been affected.

5. EXPERIMENTAL RESULTS

After connecting all the sensors on the cattle's body it will give the body temperature and heart beat graph. Using this graph we can observe the health of the cattle and detect diseases from which the cattle's are suffering. The screenshots of graphs are shown below.
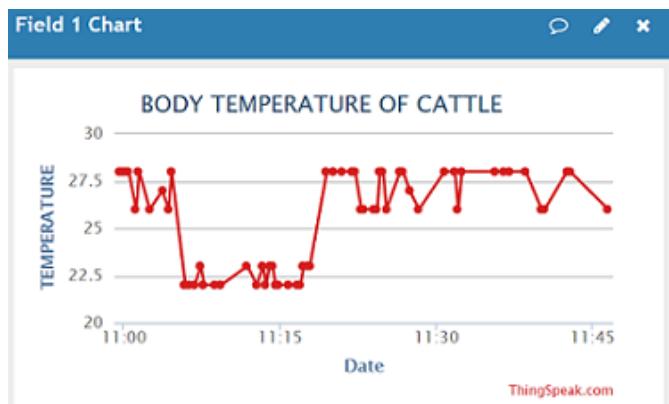

**Fig-5:** Screenshot showing the graph of body temperature
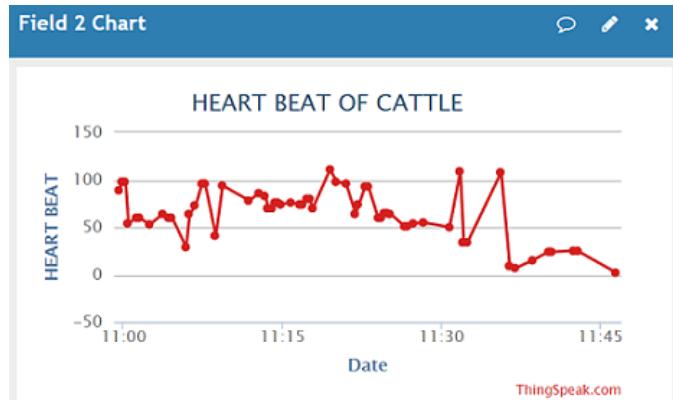
Fig-6: Screenshot showing the graph of heart beat

The GSM is used to notify the farmer with SMS when there is any abnormal change in the health of the cattle. The following screenshot shows the SMS sent to the farmer when the body temperature of the cattle goes beyond the normal range.
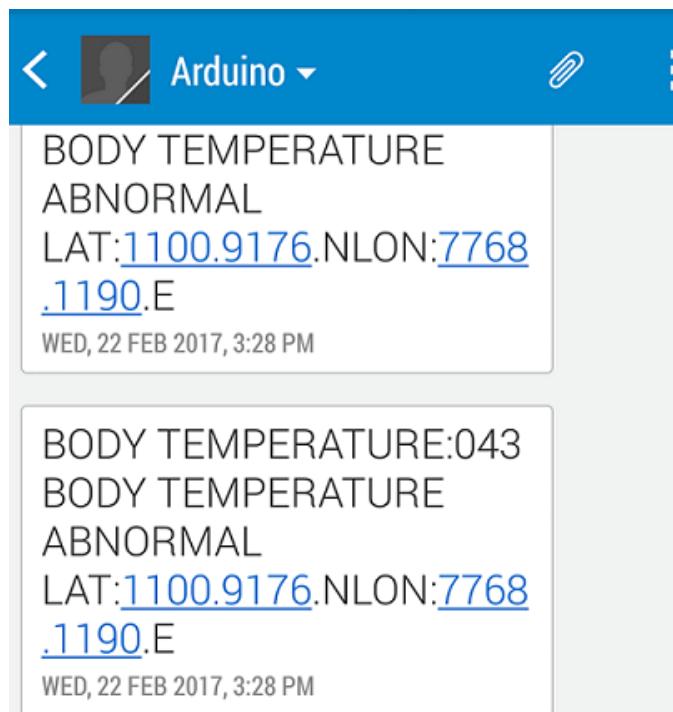

Fig-7: Screenshot showing the SMS sent through GSM

6. CONCLUSION

This paper reviews health and environmental monitoring of cattle and to track location of the cattle. We propose that IOT based Cattle health and environment monitoring system should be installed on farms to gather ecological parameters which shall then facilitate farmers in monitoring the animals from outside the farm. If any abnormalities found in the cattle, it will be notified to the farmer via SMS. The values got

from the various sensors are been continuously monitored in the internet. Hence it is time consuming and is also difficult to track the location of animals. In the proposed system, without human involvement health status of the animals can be monitored. If there is any abnormality in the health condition of cattle remedies can be taken quickly. Hence it is more effective and helps in increase of production of milk.

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