Cattle Health Monitoring System Using Arduino and IOT

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Abstract **- Now a day's human cannot imagine their life without technology. Surrounding us diverse technologies are helping people to live their lifestyles with more luxury. The era has modified and developed many projects such as Advanced Cattle health Monitoring System using Arduino and IOT. In the Wireless Sensor Based cattle health monitoring system, critical parameters affecting cattle health which includes body temperature, respiration, humidity, heartbeat, and rumination are continuously monitored. In this framework, Arduino UNO microcontroller is utilized to sense the various activities of animals like body temperature, respiration, humidity, heartbeat, and rumination. ESP8266 Wi-Fi module is used as transceiver. The thingspeak app is used to display the graph.**

Index Terms **- Arduino UNO, Sensors, IOT, ESP8266 Wi-Fi module**

INTRODUCTION

We can say that the flow of animal lovers has gradually increased by the number of animal hospitals which proliferate every year. There are so many benefits of having a pet including companionship guarding the house friendship as well as a part of a family member. Pet owners now a days are very close to their pets and treat them as family members. That means health care or medical treatment is very crucial. One of the problems is caused by veterinarians or staff in health care industry is not being able to take care of the animals 24/7 (24 hours a day, 7 days a week). In general, hospitals do not have any data monitor and alert system which tracks how bad of each animal's case when there are at hospital. This is a major cause for sick animals to hindering recuperation with many likely to lose their lives.

In general, a number of information is required to be able to identify the health of an animal. This information includes vital signs, pulse, breathing rate, temperature, blood-pressure, etc. This is used in a health surveillance system, as such data is a data-indication of life. If data abnormalities occur, that may show that the vital signs of animal may be dangerous. Therefore, Web application that can monitor and record data form sick animal will play an important role. This application will focus on dogs and cats to start. Therefore, the researchers propose developing a web application to keeps track and monitor the heart rate and temperature of sick animals. It is primarily focused on recording heart rates and temperature. If the heart rate is abnormal, it can be assumed that the animal is at risk [2]. This system can control and monitor sick animal's symptoms from diagrams that showing recorded data within the system. They also can report data to veterinarian or hospital staff. When abnormal data is reported, the animals can be assisting in time which might be able to save their life in time [6].

This research focuses on tracking and monitoring the heart rate and temperatures of sick animals in crisis or animal patients requiring recovery after preliminary treatment or after surgery, etc. As well as this it will provide analysis and report the sick animals data to veterinary.

Dairy cattle's are homoeothermic and necessary to maintain continuous body temperature, respiration, humidity, heart beat and rumination. The regular temperature of cow is 38.5-39.5oC. When the temperature is below 38.5-39.5oC the diseases arise are indigestion, milk infection etc. and when the temperature is above 41oC the diseases arises are influenza and anthrax. When the temperature of the animal is very high on that time it may die. Humidity can reduce heat exchange and have enervating impact on the cattle. When the stress will be more on that time milk quality will reduce. So using this technique we can help dairy ranchers to improve milk profit, quality and it will reduce the infection stress on the dairy herd and provide great level of animal security. A wireless sensor network (WSN) is a system obtained by a huge amount of sensor nodes [9] where every node is armed

with a sensor to identify physical sensations such as temperature, stress, light etc. The sensor node is key part of a WSN. The sensor node contains hardware part which includes four sections: power and power administration unit, a microcontroller, a sensor and wireless transceiver. The sensor is the link of a wireless sensor network node which will give the atmosphere and tool status. The sensors are used to collect and transmit the signs [10], such as sensations, light and natural signs and then transfer it to the microcontroller. In this paper Arduino UNO receives the content from the sensor and development the content accordingly. The ESP 8266 Wi-Fi module will transfer the content, so that the physical accomplishment of interaction can be achieved. For IOT wireless sensor network will become major technology. So to monitor cattle health five sensors are used i.e. body temperature, respiration, humidity, heart beat and rumination.

RELATED WORK

In recent times, animal welfare had become an increasing concern due to a shift from small sized labor-based farms to much larger autonomous and industrialized farms. In 2001, A system was invented in which data was manually entered into the integrated electronic data base system. The prior objective of the system was that it could allow the persons to identify their animals with the help of electronic identification units. They were mainly of the form of collars, ears tags and bolus in the stomach [1]. In 2003, The bovine mobile observation operation unit was designed to communicate with a variety of sensors. It used Bluetooth links to send the data back to a farmer, a veterinarian etc. microchip PIC micro-controller is the important components of BMOO. For this purpose, the animals should be within 10 meters range which is used to prevent the spread of disease [2]. In 2012, A system was invented to monitor the health of cattle using a wireless sensor mote. It used in-network processing algorithm to monitor the data [3].

For earlier year, dairy farm and farmers used the special technique for detection of animal health related diseases and it require the continuous or daily to daily base observation which again require the excessive labor if we consider the dairy farm cattle's health monitoring. sometime such technique gives the wrong result which was different from the actual health status of cattle's. This can cause the harmful effect on the cattle health .so there must be the proposed automatic health monitoring system which keep the record health parameter fast and accurate so that proper treatment use.

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 be 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 heartbeat 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 talk 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.

system architecture

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 heartbeat. The arduino UNO microcontroller is used to gather data from the sensors. The body temperature and heartbeat 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 heartbeat 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. The description of the proposed system is explained with architecture diagram and module explanation. The various types of sensors such as thermistor, heartbeat 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 heartbeat rate of a cattle is 48 to 84 beats per minute. The arduino UNO is utilized to collect various health parameters such as body temperature, heartbeat, location of animals and environmental parameters such as temperature.

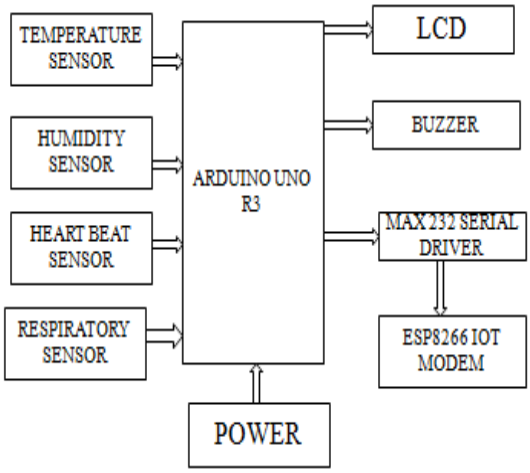

Fig 1: Block Diagram

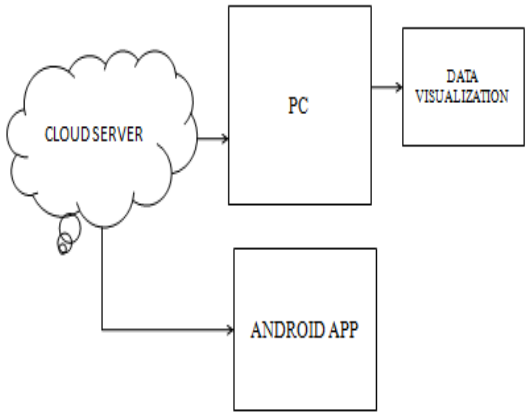

Fig 2: Monitoring Unit

Hardware Requirements

- Arduino Uno R3
- Lm35 Temperature Sensor
- Pulse Sensor
- Respiratory Sensor
- Dht11 Humidty Sensor
- Esp8266 Iot Modem
- Buzzer
- Power Supply Unit
- 16*2 Lcd

Software Requirement

- ARDUINO IDE
- Embedded C

HARDWARE IMPLEMENTATION

Arduino UNO

The Arduino UNO is an open-source microcontroller board based on the Microchip ATmega328P microcontroller and developed by arduino. The board is equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards (shields) and other circuits. The board has 14 Digital pins, 6 Analog pins, and programmable with the Arduino IDE (Integrated Development Environment) via a type B USB cable. It can be powered by a USB cable or by an external 9-volt battery, though it accepts voltages between 7 and 20 volts. It is also similar to the Arduino Nano and Leonardo. The hardware reference design is distributed under Common Creative Attribution Share-Alike 2.5 license and is available on the arduino website. Layout and production files for some versions of the hardware are also available. "UNO" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The UNO board and version 1.0 of arduino Software (IDE) were the reference versions of arduino, now evolved to newer releases. The UNO board is the first in a series of USB arduino boards, and the reference model for the arduino platform. The ATmega328P on the arduino UNO comes preprogrammed with a boot loader that allows uploading new code to it without the use of an external hardware programmer. It communicates using the original STK500 protocol. The UNO also differs from all preceding boards in that it does not use the FTDI USB-to serial driver chip. Instead, it uses the

Atmega16U (Atmega8U2 up to version R2) programmed as a USB-to-serial converter.

Fig -3: Arduino Board

LCD

Liquid Crystal Display (LCD) is used to display the output to the user in the form of GUI (Graphic User Interface) and a mono chromatic display. LCD used in this project is JHD162A series. There are 16 pins in all. They are numbered from left to right 1 to 16 (if you are reading from the backside). Generating custom characters on LCD is not very hard. It requires the knowledge about custom generated random-access memory (CG-RAM) of LCD and the LCD chip controller. Most LCDs contain Hitachi HD4478 controller. CG-RAM is the main component in making custom characters. It stores the custom characters once declared in the code. CG-RAM size is 64 byte providing the option of creating eight characters at a time. Each character is eight byte in size.

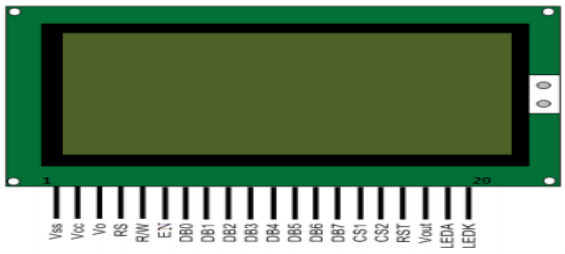

Fig 4: LCD

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-5: DHT11 sensor

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.

Heartbeat sensor

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

ESP8266 Wi-Fi module

The continuously sensed data from thermistor and heartbeat 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 APIis used to represent the data graphically in web. This helps the farmers and doctors to monitor the cattle from anywhere outside the farm.

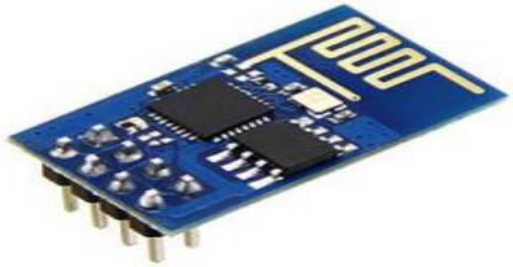

Fig-6: ESP8266 Wi-Fi module

Health monitoring widget

he IOT thingspeak monitor widget is used to monitor the health parameters such as body temperature and heartbeat 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.

RESULTS AND DISCUSSION

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.

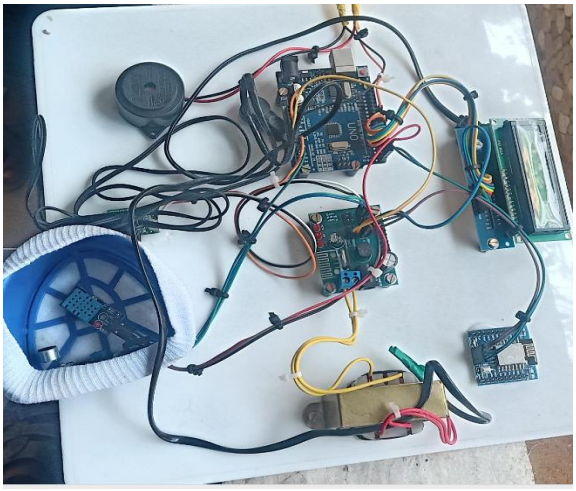

Fig 7:Experimental setup

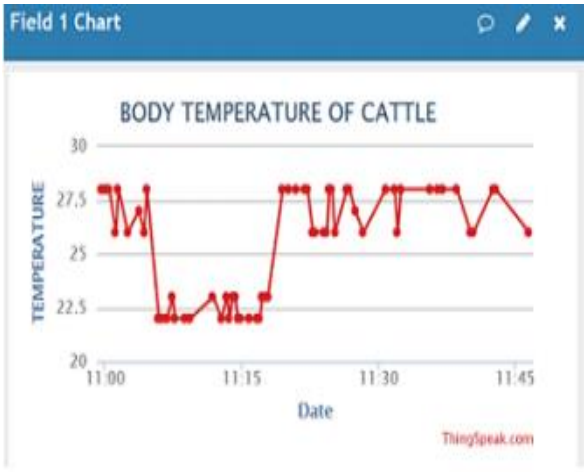

Fig 8. Screenshot showing the graph of body temperature

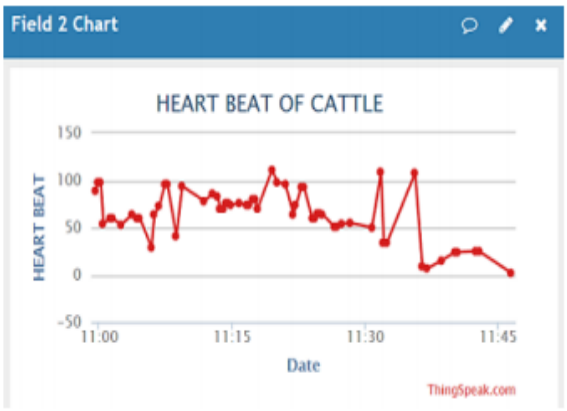

Fig 9. Screenshot showing the graph of heart beat

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 being 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. Here sensors are used for detecting various health parameters of the cow such as body temperature, humidity and respiration etc. The sensors are interfaced with Arduino UNO and then it will display the graph on the I chart app through ESP8266 Wi-Fi module. This advanced cattle health monitoring system can replace this manual process for recognizing the various diseases. This system is very much helpful for farmers and also for doctors because it is accurate than manual observation.

REFERENCES

[1] S. Divakaran, L. Manukonda, N. Sravya, M.M. Morais and P. Janani, ―IOT clinic-Internet based patient monitoring and diagnosis system‖, In:

2017 IEEE International Conference on Power, Control, Signals and Instrumentation Engineering (ICPCSI). IEEE, 2017. pp. 2858-2862.

[2] D.A. Gurjar and N.A. Sarnaik, ―Heart attack detection by heartbeat sensing using Internet of Things: IoT‖, Heart, 2018, 5.03.

[3] M.A. Mahant, N.A. Kulkarni, S.A. Mehta, S.R. Nigewan, V.R. Jain, M.A. Mahant and V.R. Jain, ―Modeled Sensor Database for Internet of Things‖, International Journal, 2017, 4, pp. 65-68.

[4] A. Patil, C. Pawar, N. Patil and R. Tambe, ―Smart health monitoring system for animals‖ In: 2015 International Conference on Green Computing and Internet of Things (ICGCIoT). IEEE, 2015. pp. 1560-1564.

[5] Y.S. Shih, H. Samani and C.Y. Yang, ―Internet of Things for human—Pet interaction‖, In: 2016 International Conference on System Science and Engineering (ICSSE). IEEE, 2016. pp. 1-4.

[6] D. Smith, S. Lyle, A. Berry, N. Manning, M. Zaki and A. Neely, ―Internet of Animal Health Things Opportunities and Challenges‖, University of Cambridge, 2015.

[7] Mekha, P., Dullayachai, K., & Changkamanon, A. (2017, March). Stock recording and cost analyzing system for chicken farm. In 2017 International Conference on Digital Arts, Media and Technology. (pp. 432-436). IEEE.

[8] Goutal, C. M., Keir, I., Kenney, S., Rush, J. E., & Freeman, L. M. (2010). Evaluation of acute congestive heart failure in dogs and cats: 145 cases (2007–2008). Journal of veterinary emergency and critical care, 20(3), 330-337.

[9] K. D. Smith. "A Wearable Cattle Health Monitoring System with an Emphasis on Motion-Based Behavior Assessment," Electrical and Computer Enginnering. Manhattan: Kansas State University, 2006.

[10] Chong, C.Y.; Kumar, S.P.; Hamilton, B.A. sensor networks: Evolution, opportunities and challenges. Proc, IEEE 2003, 91, 1247-1256.

[11] Kwon, O-B.; Kim,J-H. A basic Direction for building radio frequency identification logistics information system. M85; Korea rural economics institute: Seoul, Korea, December 2007.

[12] Pyo, c-s.; Chea, J-S. Next- generation RFID/USN technology development prospects. Korea Inform. Commun. Soc.Inform. Common.2007, 24, 7-13.

[13] http://www.instructables.com/id/How-tointerface-Humidity-and-Temperature-DTH11-Se

[14] http://www.micropik.com/PDF/DHT11.pdf

[15] Kumar, Anuj, and Gerhard P. Hancke. "A Zigbee-based animal health monitoring system." IEEE sensors Journal 15.1 (2015): 610-617.

[16] Mr. S.Jegadeesan& Dr.G.K.D.Prasanna Venkatesan has given an idea about Health monitoring system using ARM7 microcontroller and biological parameter in his paper “Distant Biometry In Cattle Farm Using Wireless Sensor Networks” published in 2017

[17] S. Warren, D. Andresen, L. Nagl, S. Schoenig, B. Krishnamurthi, H. Erickson, T. Hildreth, D. Poole, and M. Spire. "Wearable and Wireless: Distributed, Sensor-Based Telemonitoring Systems for State of Health Determination in Cattle," 9th Annual Talbot Informatics Symposium, AVMA Annual Convention, Philadelphia Convention Center, Philadelphia, PA, July 23-27, 2004