Cattle Diseases Prediction using IOT and ML - A Review

Namana A, Nishkala Gowda B Y, Pratheeksha C, Prajwal K S, Charunayana V

Abstract: Due to the everchanging environment, the cattle's are in risk of getting affected by diseases and this in turn affects the economy. There will low productivity, less yield . It is still hard to forestall farm animals sicknesses using current monitoring systems that tune cattle activity and consequently the environmental situations of cattle .In this paper, we design a cattle health monitoring system using IOT and ML to a prevent livestock diseases, like anthrax disease, using dedicated sensors. We collect information using various. With the assistance of machine learning algorithm, we will predict the disease and send notification to the respective cattle owner and also the doctor in charge.

Key Words: accelerometer, Dallas temperature, ESP8266 Wi-Fi module, IOT, Machine learning, microphone, NodeMCU.

I. INTRODUCTION

In India there are abundant rural regions where human beings still rely on the farm animals as their source of income. Their mode of dwelling largely depends on the cattle's health condition as most of the human beings depend on the dairy merchandise for his or her livelihood and also for those farmers who cannot afford superior machinery for the agricultural cause and still continue to be dependent on the livestock for it. Availability of veterinary doctors is also very rare in rural areas. Farmers residing at rural areas have to travel a lot with their cattle to veterinary hospitals which cost a lot to them. When the cattle's health isn't good, they get it treated. After treatment, if the cattle's health doesn't improve then again it's a complete waste of money spent on both travel and treatment.The device will constantly check the health parameter of the cattle and send to the owner hence it will under the care of the owner all the time. In case of any abnormal reading , it will sent to the owner. To look at an animal's health, it's crucial to increase a per-animal unit on the manner to build up bio-medical records from sensors and wirelessly transmit this records to a base station. The sensors are based or chosen depending on how the it helps in analyzing the disease the cattle has been affected.

This paper gives a basic idea of the usage of different types of sensors which helps in predicting the disease. The device will be a wearable device around the neck.

II. LITERATURE SURVEY

It focuses on mapping of sicknesses in dairy cow to the relevant sensors which will help in future to create smart system in future. This paper identifies three sensors which are temperature, accelerometer and microphone that are required to decide the fitness of the cattle [1]. The WSN is employed for monitoring cattle health for early and correct detection of diseases and their prevention from spreading [2]. The proposed system consists of non-invasive, wearable sensors that will be placed on the cow's neck. Basic information about health, sensors, the layout and improvement of a prototype is deliberated. The said prototype will have three foremost elements, they're -sensing, statistics processing and facts analysis [3]. It uses Arduino UNO, GSM, ESP8266 Wi-Fi module to create a smart health monitoring system. Uses GPS to know the location of the cattle and a DHT 11 sensor which records the environment condition [4]. The primary goal of this method is to create a smarter cattle farming infrastructure and to enforce a non-invasive wearable to hint livestock physiological and biological activity by using IOT. The system saves farmers time and maintenance costs ensuring better cattle health and high yield[5]. The paper gives a review of the structured overview of the dairy health management sensor systems. It says about levels in which the senor system can be integrated and also the outcome can be predicted [6]. This paper uses low cost GPS and prediction algorithm to give high classification rates. We managed to achieve an average classification success rate of 86.2 percent of the four activities for our dataset: eating / seeking (90.0 percent), walking (100 percent), lying (76.5 percent), and standing (75.8 percent) [7].The solution proposed facilitates a preferred requirement to continually assess the circumstances of individual animals, to aggregate and report these data to the farmer manager.The proposed IRP can notably decrease the impact of mobility beneath varying "off" probability, different amount of sensor node and therefore the prevalence of network reconfiguration [8]. The papers focus on GPS collars on the cattle to monitor the movement of the cattle. The results of these tests show that the collars generally provide data with horizontal accuracies between 4 and 5 m [9].

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Wireless Sensor is installed on farms to help in increasing the productivity of the cattle and the farm. Web application which displays the various condition of the environment of the farm and also has options to change the environment condition [10]. This paper reviews other cattle monitoring systems and hence the importance of using wireless sensor networks to monitor bovine core body heat and site. Cattle temperature and location are defined [11].

III.   PROPOSED SYSTEM

Cattle health monitoring system provides the cattle's accurate and actual time health parameters which can be extremely helpful in tracking the circumstances of fitness and identifying any exchange of actions and health problems. It can therefore be a very useful tool for the farmer to evaluate the situation on his own without relying on the veterinarians for any small problem. Sometimes it can also be used by the veterinarians to predict the disease using IOT and machine learning techniques which is developed in this project. The doctor can just keep updating the status of health of the cattle and the machine predicts the cattle's actual state of health more accurately. To know the health of the animals, different sensors are also used to observe these specific areas for health monitoring purposes. Here three primary sensors — Temperature, Accelerometer and Microphone are used which are needed primarily to evaluate the cattle's health quotient. The temperature sensor will assist to determine if the farm animals have any abnormal variations in temperature. The accelerometer will help in determining the movement of the cattle's activity or head and neck. The microphone is used to determine the cattle's different sounds, such as bellowing in distress, discomfort, pain, or heat. The microphone can determine the sound of respiration, weeding, ruminating or coughing. If we evaluate these outputs using a smart algorithm, we can determine whether the produced values exceed the threshold values. These criteria can help in the diagnosis of animal health problems and warn the farmer or the veterinarian. A server is built that accepts the outputs of the sensor and the analysed output of the sensor is transmitted to the cloud with the help of IoT. Computer programs are allowed to learn from experience, examples, and analogies using the correct framework. As learning happens, the program's capabilities become smarter, and the program becomes able to make informed decisions. Hence, cattle disease prediction becomes more precise with the help of sensors, IOT and machine learning.
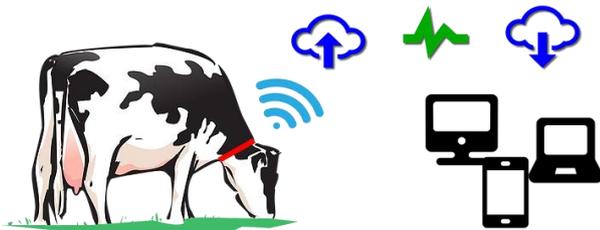
IV.   MODULE DESCRIPTION

4.1 NodeMCU
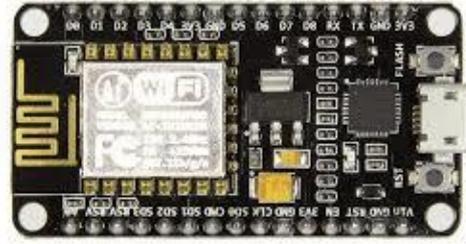
The NodeMCU (Node Microcontroller Unit) is an open-source firmware and development kit that's built around a really cheap System-on-a-Chip (SoC) called the ESP8266. The ESP8266 is a small module that lets microcontrollers connect to the Wi-Fi network and make simple TCP / IP connections.

4.2 Dallas temperature

The DS18B20(Dallas temperature sensor) is a small temperature sensor with a built in 12bit ADC. It can be easily connected to a NodeMCU digital input. The sensor communicates over a one-wire bus and requires little within the way of additional components. The sensor works with the contact methods of 1-Wire. It only requires the data pin connected with a pull-up resistor to the microcontroller, and the two other pins are used for power as shown below. The pull-up resistor is used to hold the line in good condition while the bus is not in operation.

4.3 Accelerometer

Accelerometers typically contain a piezoelectric crystal element bonded to a mass. When the accelerometer is challenge to an accelerative pressure, the mass compresses the crystal, inflicting it to supply an electrical signal it's proportional to the quantity of force applied.

The basic principle of operation behind the MEMS accelerometer is that the displacement of a small proof mass etched into the silicon floor of the microcircuit and suspended by means of small beams,that is regularly the source of the limited operational bandwidth and non-uniform frequency response of accelerometers.

4.4 Microphone Sensor

A microphone is a sensor or transducer that transforms sound into electrical signals. As the moving plate (diaphragm) vibrates with the sound wave in time, the distance between the plate and the capacitance is changed. The capacitance changes can then be converted to an electric signal. A microphone is an acoustic to electrical transducer or sensor which detects and converts sound signals into an electrical signal.Vibration of the diaphragm causes the microphone to vibrate surrounding additives. Conversion of these vibrations to an audible signal is added.

4.5 MQTT
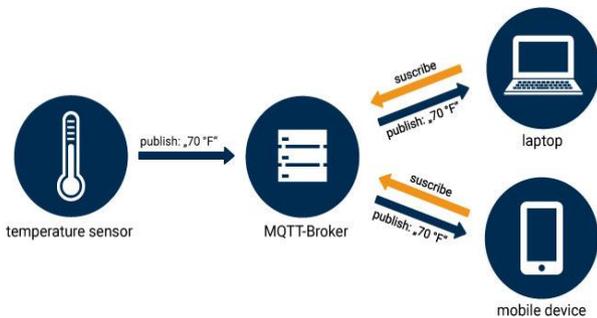
MQTT can be an easy to use messaging protocol optimized for low bandwidth limited gadgets. Yeah, that's the ideal solution for applications on the Internet of Things. MQTT lets you send out put control commands, read and publish data from sensor nodes, and much more. An MQTT broker may be a server that receives all of the clients' messages and then routes the messages to the appropriate clients. An MQTT client is any computer (as well as a full-fledged server from a microcontroller) that runs a MQTT library and connects to a MQTT dealer over a network. MQTT was constructed to be a low-overhead protocol that strongly taken into consideration bandwidth and CPU limitations. MQTT fundamentally is a publish/subscribe protocol. It lets in customers to connect as a publisher, subscriber, or both. You connect to a broker that handles all the message passing.

V. RESULTS AND DISCUSSION

The proposed project which we have developed is a IOT and ML oriented project which is first of its kind that is implemented for Cattle Health Monitoring System. The project involves prediction and analysis of Cattle Health condition based on records. We have three objectives which involves the early prediction of the cattle diseases The First objective is real time monitoring the cattle body temperature, cattle movements and Bp variations using Sensors. The Second objective is to store the sensor values through NodeMCU and send notification to farmers using android smart phone. The Third objective, for prediction and analysis of cattle diseases using Naive Bays algorithm One of the easiest ways of selecting the most probable hypothesis given the data that we have that we can use as our prior knowledge about the problem. Bayes Theorem provides a way that we can calculate the probability of a hypothesis given our prior knowledge. Bayes Theorem is stated as:

$$P(h|d) = (P(d|h) * P(h)) / P(d) \dots\dots\dots\dots\dots (1)$$

Where

*$P(h|d)$ is the probability of hypothesis h given the data d. This is called the posterior probability.

* $P(d|h)$ is the probability of data d given that the hypothesis h was true.

* $P(h)$ is the probability of hypothesis h being true (regardless of the data). This is called the prior probability of h.

* $P(d)$ is the probability of the data (regardless of the hypothesis).

You can see that we are interested in calculating the posterior probability of $P(h|d)$ from the prior probability $p(h)$ with $P(D)$ and $P(d|h)$.After calculating the posterior probability for a number of different hypotheses, you can select the hypothesis with the highest probability. This is the maximum probable hypothesis and may formally be called the maximum a posteriori (MAP) hypothesis.

This can be written as:

$$MAP(h) = max(P(h|d)) \dots\dots\dots\dots\dots\dots\dots (2)$$

or

$$MAP(h) = max((P(d|h) * P(h)) / P(d)) \dots\dots\dots (3)$$

The P(d) is a normalizing term which allows us to calculate the probability. We can drop it when we are interested in the most probable hypothesis as it is constant and only used to normalize. Back to classification, if we have an even number of instances in each class in our training data, then the probability of each class (e.g. P(h)) will be equal. Again, this would be a constant term in our equation and we could drop it so that we end up with:

$$MAP(h) = max(P(d|h)) \dots\dots\dots\dots\dots\dots\dots (4)$$
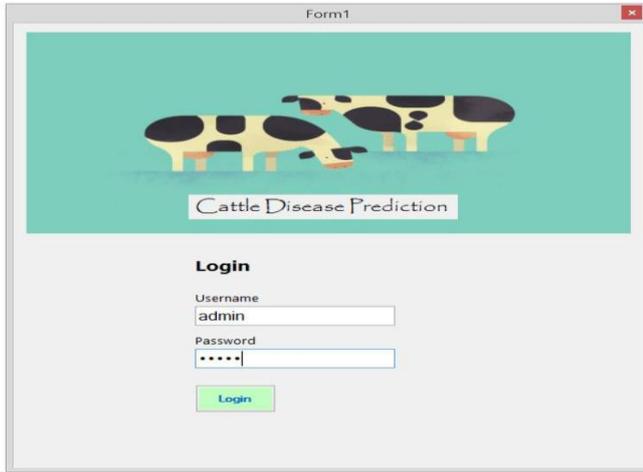
Fig 1: Desktop application
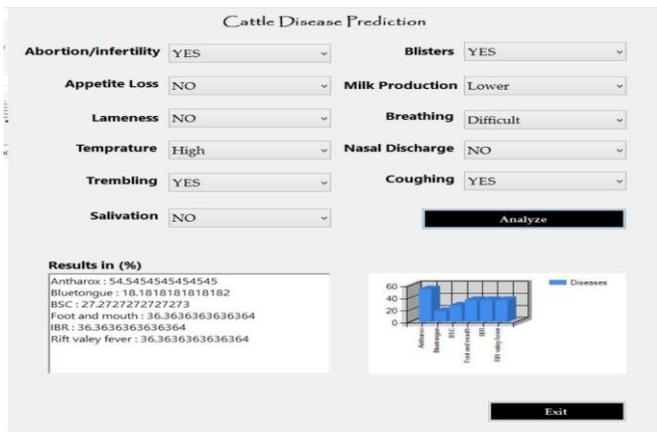

FIG 2: PREDICTING THE DISEASE

**Fig 3: Notification in the application**
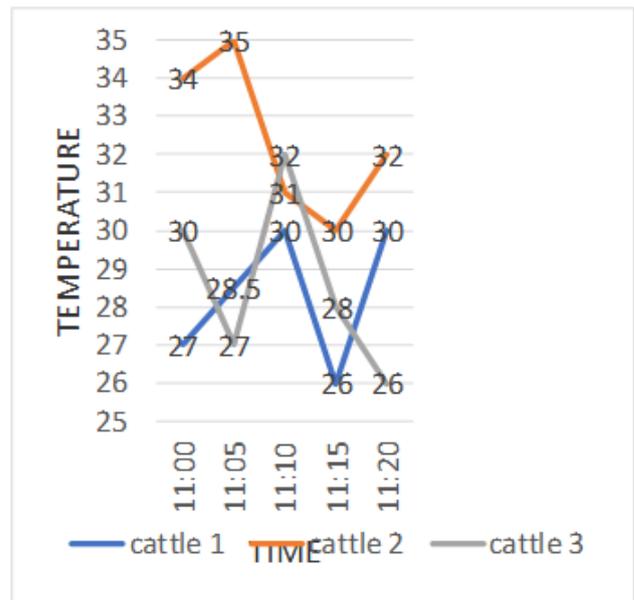
Fig 4: Graph analysis for constant monitoring of temperature

VI. CONCLUSION

Due to this system we can alert the owner in advance. From this the cattle's life can be saved. Also this model is very cost efficient so that it can be afforded by everyone. This model can be presented as a wearable device around the neck which is the best place for the sensor that we are using. For this model to work hotspot is necessary for the data to be sent to the conclusion. The model doesn't exactly predict the disease but it can alert the owner. With the help of this alert we can be more aware of the situation that the is in cattle. But for more precision the doctor's check-up and blood test are needed.

FUTURE SCOPE

The system that we have developed is done only using three sensors that are temperature sensor, microphone sensor and accelerometer. The prediction that is done is not so accurate. Hence, we have collected the data for 11 parameters which gives more efficiency. Extra sensors like humidity sensor and BP sensors can be used. Also, image processing can be added to increase the efficiency. We can also add GPS for us to know the position of the cattle. By incorporating this, a better and more efficient cattle health monitoring system can be created.

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