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INTERNET OF THINGS (IOT) BASED CATTLE MONITORING AND MANAGEMENT

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ABSTRACT: Cattle are an important part of human life and they are to be taken care of. A system to track and monitor the cattle remotely is required. Lots of people leave their cattle for grazing on open roads which causes traffic congestion. This system should be intelligent enough to alert the owner of the cattle with the current locations, if it is causing any traffic congestion. This project is about designing an android based application that is able to track the current location of a farmer's livestock. This application can assist farmers to track their lost or stolen livestock. Currently, farmers needs to manually look for their livestock without any proper assistance. In addition, the process can consume a lot of time and energy. The current location of the livestock will be collected and uploaded by the GPS collar to the database. Once the location data is successfully uploaded, the livestock location can be viewed with the farmer's android device. We use sensors to collect and transmit the data to Raspberry pi. Raspberry pi receives the data from sensors and transmit the content accordingly.

Keywords- Raspberry pi, Gsm module, gps system

I. INTRODUCTION

Most farmers do not own any dedicated monitoring system for their animals. Due to that, their animals are exposed to dangers such as theft. Many farmers leave their cattle for grazing nearby highways, roads which causes traffic congestion.

To overcome this problem, we developed a project called cattle monitoring and management system using IoT. This project works with a GPS collar. The collar will be strapped at the animal's neck. The function of GPS collar is to update the location of the animal via GPS. To locate the location of their livestock, farmers needs to request the location of their livestock through the android application. Once requested, commands from the application will prompt the GPS collar to provide its current location. Finally, the GPS collar will send its current location back to the android application. While grazing if the cattle causes any traffic congestion, then an alert message should be sent to the owner of the cattle. This process will take less than a few minute depending on network coverage. This application provides better alternative for farmers to track their livestock whether it is missing or stolen. A primary advantage for monitoring livestock is to help farmers track their cattle, which will help to manage the livestock in an easier and efficient manner.

II. LITURATURE SURVEY

Existing system

The current system has no proper solution for monitoring and management of cattle in India. There exist separate solutions for separate problems like tracking location of cattle, health issues of cattle and traffic related issues. There is no proper solution for traffic related problems.

Drawbacks of the existing system

Missing of data during tracking:

Current systems use geo-location tags that hold the information about the user. These tags do not submit live tracking data. The data has to be recovered by manually scanning each tag. This may induce loss in data by human errors such as forgetting to scan some tags.

Locating cattle was troublesome in case they wandered too far.

As the geo-location tags do not submit live tracking data, it would be very hard to locate the cattle if they went outside the city limits.

Limited knowledge about bio sensors among farmers.

Bio sensors that detect health issues in cattle are not frequently used in India as most farmers are unaware about these kind of sensors, their usage and their benefits.

Implementing all three systems separately for farmers makes it expensive.

Implementing all the systems separately will cause the farmer to have to go to multiple manufacturers. The maintenance of these systems separately would be cost inductive as different manufacturers will quote different prices.

Proposed system and merits

Using RFiD chips embedded in collars of the livestock:

GPS tracking of cattle can be achieved by mounting RFiD chips and GPS sensors which will transmit the data to owner.

Using IoT to send and receive data from the RFiD chips:

We use Raspberry pi and GSM module for transmitting the message to the owner as well as the user.

Health related issues can be diagnosed by using the bio sensors.

Using an app based interface to manage and process all the data:

Developing an application for owner to track, manage and monitor cattle details.

Some of these advantages are

1. Bio sensors too can be embedded, for providing real time data about health status of each individual livestock.

2. This data can be used for breeding programmes, which require optimal conditions.
3. Better yield can be observed by this method.

Alert message sent to owner for traffic congestion which is useful for avoiding accidents.

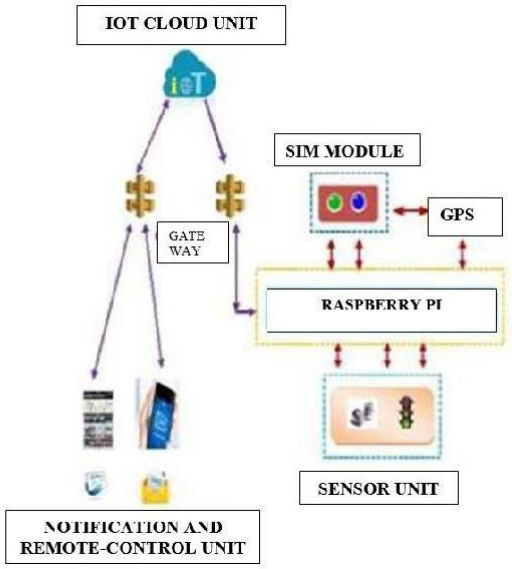

Fig 1. Block diagram

The sensor unit in fig 1 will send raw data to Raspberry pi which process the data and update it to cloud storage. The gateway will authenticate which data belongs to which user. It also sends data to user API. GPS module track live location of the cattle and sends the data to Raspberry pi. Sim module will have information about user or owner and processed data from Raspberry pi will be sent to owner or user based on identification. The notification is sent to user or owner through notification and remote-control unit. Here the data from cloud storage is used.

III. METHODOLOGY

The study helps to clearly understand the concept, approach and certain terminology that revolve around the project. The data from the GPS collar will be uploaded to the database and then the database will send the last data uploaded to the Android application.

The development of both GPS tag and Android devices are done separately. This is because, both tasks are connected only to the database. For GPS collar, the task that is required to accomplish is to link the tag to the database.

As soon as GPS tag and the Android app are working, the system will be tested. This project is divided into two implemented parts: software and hardware. The software part is programmed and that works in (Java /other programming language) Environment and the large database system is designed by (MySQL Database Server version). The website uses (PHP scripting language, CSS and HTML), and the web server uses (Apache web server) using Wamp Server program. The hardware part consists of GPS module with long antenna, USB cable and PL-2303 USB to UART convertor, and DC Adapter to run the devices. Heat sensors for detecting the temperature of cattle, Raspberry pi zero wireless for managing the process and GSM module for message sending.

CATTLE TRACKING AND MONITORING

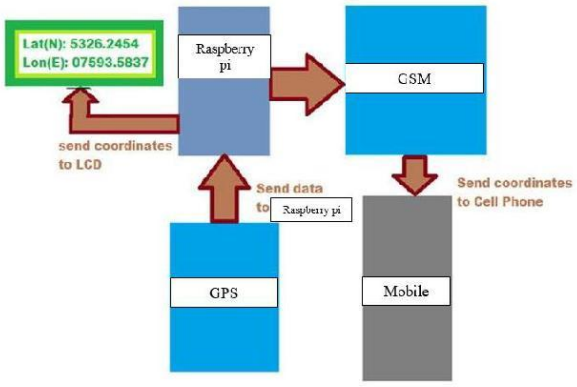

Fig 2. Tracking Module

The Global Positioning System (GPS) provides users with navigation, positioning, and timing functionality. This system consists of three segments: the space segment which describe longitude and latitude, the control segment which provides control to owner, and the user segment who uses gps. A GSM module is a chip or circuit board. It will establish the communication between a mobile device and a computing device to a GSM module.

Components

GPS Module, Raspberry pi, GSM Mobile

Working

The GPS Receiver sends raw data (location and time) to Raspberry pi which process the data. Where GSM Module (sim module) will have information about user or owner based on identification of cattle and processed data from Raspberry pi will be sent to owner or user based on identification.

Cattle identification.

In this part we are identifying which cattle belongs to which owner by scanning QR code attached to each cattle collar. This helps to identify cattle and its owner. When accidently cattle grazes on highway, by simple means of QR code we can easily call cattle owner and ask him to take necessary action.

Consider the following example. Here cattle named gowri found on highway. To inform this to his owner, we need to install qr code scanner for scanning the QR code on cattle. By scanning the QR code we will get cattle name, cattle owner name and his contact information.

You can scan this QR code for getting owner information.

CATTLE HEALTH MANAGEMENT

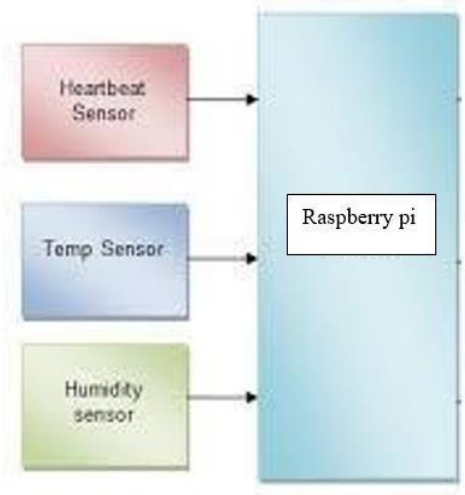

Fig 3. Health Management

Here we are using three main sensors to collect the data of cattle. Heart beat sensor measures the pulse rate per minute. If it crosses normal value, then shows the reading to owner.
Temp sensors measure body temperature of cattle. Body temperature varies depending upon the condition of cattle.

WORKING

The sensors collect the data and transmit it to Raspberry pi which process the data and display the reading. Based on the reading available owner can take action.

USE CASE DIAGRAMS

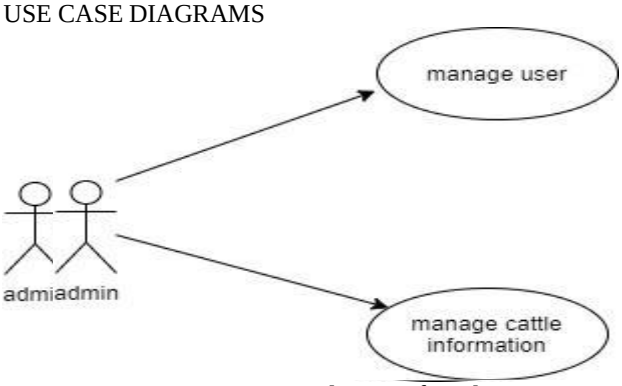

Fig 4. Use case diagram for admin

Fig 4 depicts use case diagram for admin. Admin has authority to manage cattle owner and numbers of cattle information.
Fig 5 depicts use case diagram for cattle owner. Cattle owner will be able register and login the online portal. Here he will be provided with update profile menu for updating any other information. He also will be able to add cattle information, view cattle information and update cattle information for managing the cattle's. Also a QR code will be generated on successful registration of cattle. These QR code must be printed and attached to cattle neck. By scanning the QR code anyone will be able to identify cattle owner. These generated QR code again uploaded to server for more accuracy.

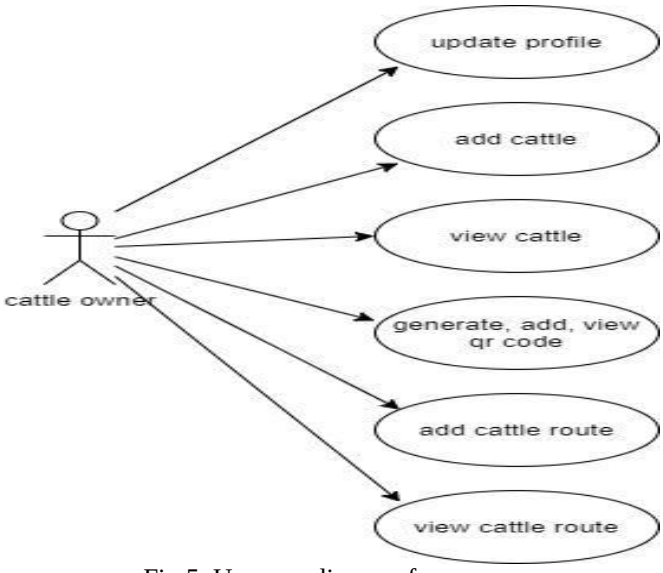

Fig 5. Use case diagram for owner

Also cattle grazing route will be auto updated using gps sensor.

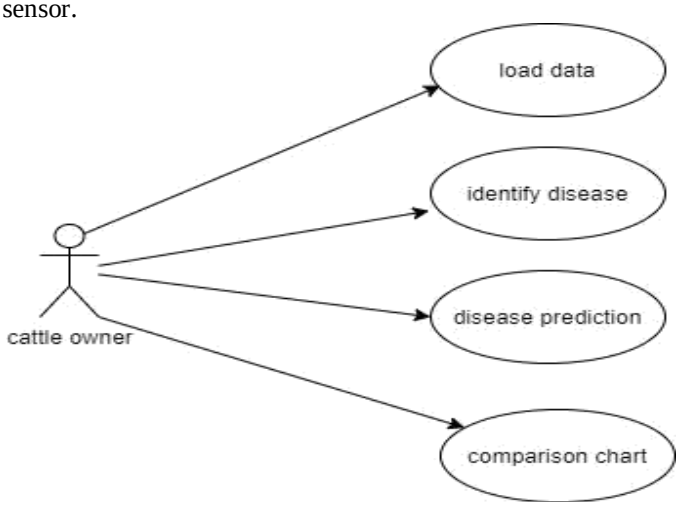

Fig 6. Use case diagram for cattle health management

Fig 6 depicts use case diagram for attle health management. Here we are using knn , naïve bayes, and decision tree algorithm to compare and predict cattle health issues. A comparison chart wiil be displayed.

Decision Tree Algorithm

Input: uploading datasets
Output: Displays whether the animal is suffering from Disease or not
Begin:

1. Scan the dataset (storage servers)
2. For each attribute a, calculate the gain [number of occurrences]
3. Let A be the attribute of highest gain [highest count]
4. Create a decision node based on a A – retrieval of nodes [Cattle] where the attribute values matches with A.
5. Recur on the sub-lists [list of animals] and calculate the count of outcomes [healthy or disease cattle] –termed as

sub nodes. Based on the highest count we classify the new node.
End.

KNN Algorithm steps
Input: uploading datasets
Output: Displays whether the animal is suffering from Disease
or not
Begin:
1. Scan the dataset (storage servers). Retrieval of required data for mining from the servers such as database, cloud, excel sheet etc.
2. Determine Parameter K= number of nearest neighbours.
3. Calculate the distance between the query-instance and all the training samples. There are many distance functions but Euclidean is the most commonly used measure.
4. Sort the distance and determine nearest neighbours based on the K-th minimum distance.
5. Gather the category X of the nearest neighbours.

6. Use simple majority of the category of nearest neighbours as the Prediction value of the query instance.
End.

Naive Bayes Algorithm Steps
Input: uploading datasets
Output: Displays whether the Cattle is suffering from Disease Diagnoses or not.
Begin:
1. Scan the dataset (storage servers). Retrieval of required data for mining from the servers such as database, cloud, excel sheet etc.
2. Calculate the probability of each attribute value. Here for each attribute we calculate the probability of occurrence.
3. Multiply the probabilities by p. For each class, here we multiple the results of each attribute with p and final results are used for classification.
4. Compare the values and classify the attribute values to one of the predefined sets of class.
End.

SNAPSHOTS
Fig 7 depicts home web page of this project. Here there is 3 sections, one admin login, second cattle owner login and the third section is about us and contact information.

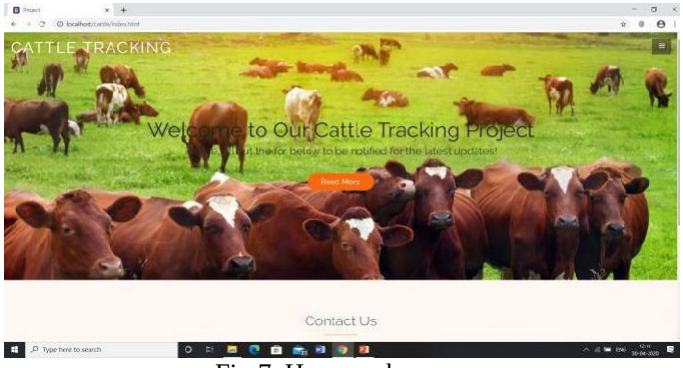

Fig 7. Home web page

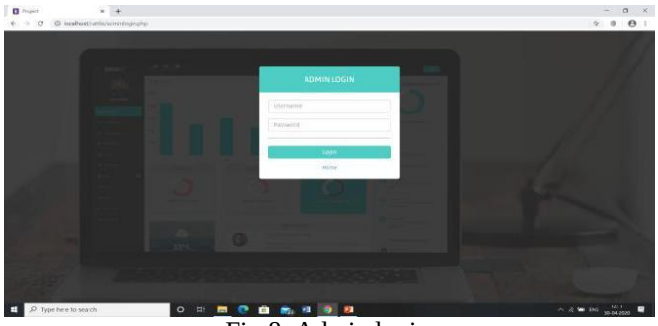

Fig 8. Admin login

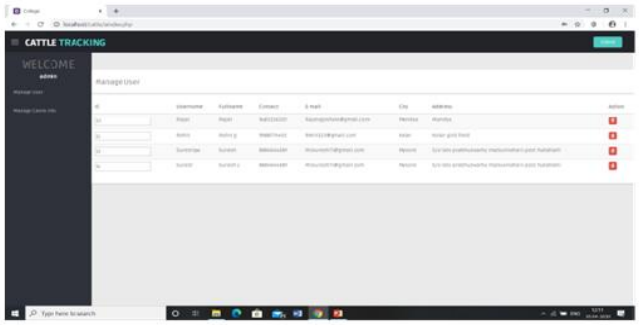

Fig 9. Admin access information


Fig 10. Cattle owner login

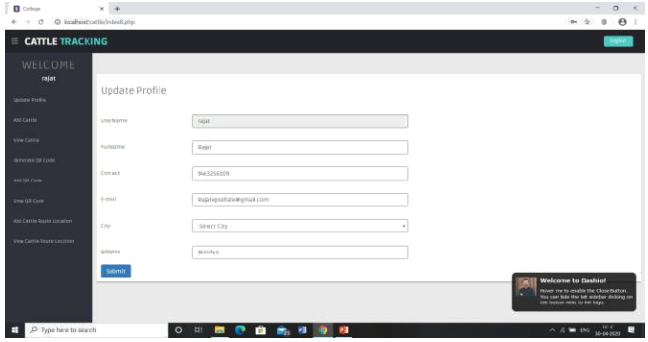

Fig 11. Cattle owner portal

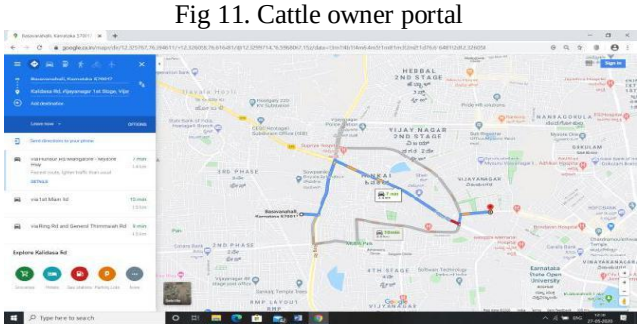
Fig 12. Tracking cattle route

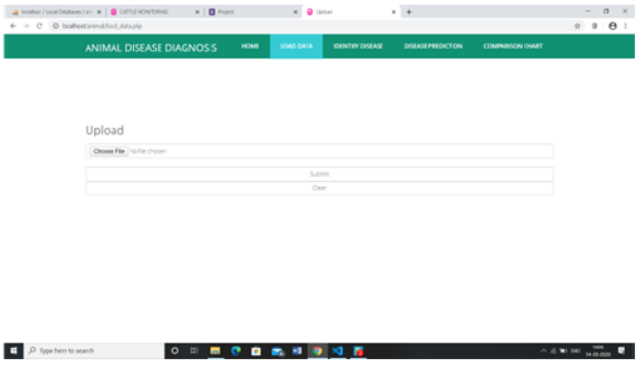

Fig 13. Uploading cattle details

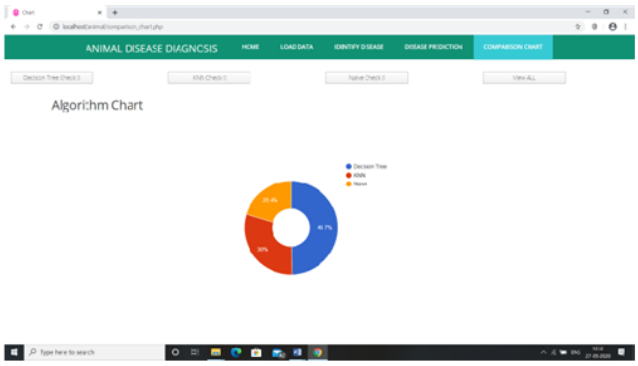

Fig 14. Comparison chart for health management

IV. CONCLUSION

By doing this project we can eliminate road accidents that happen by cattle. Also we can easily find the missing cattle. By implementing this methodology we also able manage health issues related to cattle. This system works by uploading the current location to the database from the GPS collar via internet connection. The location then can be viewed by using Android device. a system that is capable of monitoring the

Fig 11. Cattle owner portal location of the livestock was successfully built. With IOT a remote monitoring, feeding, analysing of body temperature and other health disorders can be diagnosed. We have also addressed the issue of long-distance identification of animals using sensors embedded in the RFID tag which can be tracked using GPS. By doing this project we can eliminate road accidents that happen by cattle. it gives us the power to face diseases earlier and therefore save cattle's lives through the anticipation of cure. In this application, Data Mining algorithms KNN, Decision tree and Naive Bayes, to predict animal is healthy or unhealthy. Simulation results showed that Naive Bayes classifier proved its performance in predicting with best results in terms of minimum execution time and this project user can easily get treatment information by selecting it.

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