VIRTUAL FENCING

Nithin P
Student, Computer Science & Engineering,
Vemana Institute of Technology,
Bengaluru-34, India
Prathviraj N Doshetty
Student, Computer Science & Engineering,
Vemana Institute of Technology,
Bengaluru-34, India
Shobith M P
Student, Computer Science & Engineering,
Vemana Institute of Technology,
Bengaluru-34, India
Varun B S
Student, Computer Science & Engineering,
Vemana Institute of Technology,
Bengaluru-34, India
Ashwini M
Asst.Professor, Computer Science & Engineering,
Vemana Institute of Technology,
Bengaluru-34, India

Publication History
Manuscript Reference No: IJIRAE/RS/Vol.09/Issue08/SPAUAE10086
Research Article | Open Access
Peer-review: Double-blind Peer-reviewed
Article ID: IJIRAE/RS/Vol.09/Issue08/SPAUAE10086
Received Date: 12, July 2022 | Accepted Date: 25, July 2022 | Available Online: 12, August 2022
Volume 2022 | Article ID SPAUE10086 https://www.ijirae.com/volumes/Vol9/iss-08/07.SPAUAE10086.pdf
Article Citation: Nithin,Doshetty,Shobith,Varun,Ashwini(2022). Virtual Fencing. International Journal of Innovative Research in Advanced Engineering (Vol. 9, Issue 8, pp. 187–191). AM Publications, India
doi: https://doi.org/10.26562/ijirae.2022.v0908.07 **BibTeX key**
Academic Editor-Chief: Dr.A.Arul Lawrence Selvakumar

Abstract: The virtual fencing system for animals is explained in this project. The current concept is a way to keep animals under control and track of their health without using obvious physical barriers. Animals can be kept under control by being exposed to one or more sound signals and electric shocks when they try to enter a prohibited area. Animal tracking should be possible with this research. A solution to issues like the high cost of upkeep and repair for actual fences is to create a virtual fence project. A smart collar on animals' necks can be recognized by using a virtual fence app. Each smart collars includes a global location system (GPS), and an electric shocker. On-farm tests with an animal using a smart collar are shown, along with the stimuli and categorization outcomes.
Keywords: Fencing, Shocks, GPS, Collar.

I. INTRODUCTION

The IoT (Internet of Things), which includes connected vehicles, smart cities, and more efficient businesses, has the potential to revolutionize the way we live. The biggest potential impact, meanwhile, could come from the use of IoT in agriculture. Growers and farmers will be able to cut waste and increase productivity thanks to smart farming based on IoT technologies. Smart farming is a high-tech, capital-intensive method of producing clean, sustainable food for the masses. It is the integration of contemporary communications technology with farming. In sensor-based smart farming, a system is created for tracking the crop field and managing animals (light, humidity, temperature, soil moisture, etc). The farmers can check the agricultural conditions from anywhere. When compared to the traditional method, IoT- based smart farming is significantly more efficient. The virtual fence is implemented by the virtual fencing devices using an algorithm that incorporates GPS and animal behavior. Virtual fences help to create a border to contain animals in a similar way to physical fences, however unlike traditional fencing, they don't erect an actual wall. Although it has been shown that virtual fencing has the ability to change how animals are distributed during grazing, virtual fencing technology for animals is still in its infancy compared to that for cattle. Development of animal virtual fence systems, tracking animal behavior, and increasing animal control with auditory stimuli and fewer electrical shocks all require research.

The virtual fence is separated into three zones—safe, warning, and risk—in order to achieve the purpose of remembering; the area outside the fence is known as the escape area. Other than the safe zone, the system uses distinct auditory cues for each zone.

II.SCOPE

The project's primary goal is to create a virtual fencing system for intelligent breeding. The study extends beyond a virtual fence; other features, like animal status assessments made possible by cloud data methods, are incorporated. The Internet of Things-based smart agricultural system is not just intended to replace traditional, large farming operations; it can also be used as new levers to support other emerging or well-established trends in agriculture, such as organic farming & family farming, and to improve highly transparent farming. To rule out the possibility of using a virtual fence as a technique for spatial animal grazing, trials have been conducted in a larger area than in prior investigations.

III. RELATED WORK

The livestock sector has done a number of researches on ICT-enabled smart farming in different nations [1]. They observe that although occasionally cattle may go in wrong way, they quickly learn about association and avoid the region. After training, the cattle begin to believe that the acoustic stimulus would be sufficient since they have learned to correlate it with the electrical stimulus. A better smart collar allows for more thorough field testing. The location of wildlife is frequently tracked using GPS technology. The actual applied stimulus appears to start with aural tones and end with electric shocks. By discriminating within the behaviour classes according to their distinctive motion features, behaviour models categorize the time - series data acquired from sensors. A three-axis accelerometer is used in models [2] to describe the movement or rotation of the leg, collar, or head of animals; a microphone is used to record the sound related to animal activity; and a GPS approach is used to depict patterns of spatial movement. These models are frequently referred to as time-based classifiers. Binary models, which may distinguish between a group of actions or identify a single behavioural episode, are the most basic behaviour models. For instance, overall eating activity of cows was identified by counting pertinent thresholds from accelerometer or microphone data, and the standing and walking behaviours of cows were distinguished using a moving average filter. Given that they just have a few parameters, binary systems [3] are easy to construct and straightforward to optimize. The class choice limits get more complicated when models are constructed to categories more behaviours. To distinguish between the classes, a high-dimensional parameter space is required. As a result, machine learning techniques are frequently used to solve issues involving many behaviour classes since they give users the means to predict complex type boundary in high- dimensional space. Technology for virtual fencing [5] has advanced quickly in recent years, and it has been shown to be both technically feasible and close to being commercially available for cattle.

IV. PROPOSED METHODOLOGY

System Architecture

We have made an effort to understand solutions for issues like grazing animals or breeding over expansive paddocks by developing a virtual fence project. Two key tasks, such as animal control and monitoring, are incorporated in the project to increase its usefulness.

Monitoring

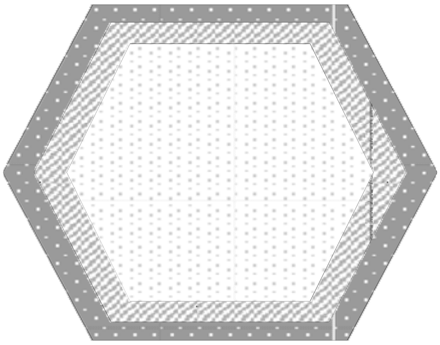
Under the phrase of monitoring, there have been two main features. One of those is observing the position of the animal and also the other is observing the animal's behavior.

Monitoring Animals Position

Animals in our programme can be monitored effectively thanks to a range of real-time methods for obtaining the animal's position. The most widely used GPS and geographic information systems (GIS) are therefore selected. The smart collar also comes with a GPS module. Although the geographic information system (GIS) is less well-known, GPS cannot potentially be used to its full capacity without GIS. GIS is a software tool needed to store and change the information that GPS acquires.

Controlling

The most important function in our system is animal control. Maintaining animals within a virtual fence and bringing back escaped animal to the fence are the two basic components of controlling animals. Returning fugitive animals won't be a major deal if escaping animals can be stopped. Animal Control using Virtual Fences A virtual fence is first built to contain animals in a certain area. Software can be used to control the virtual fence. Moving and installing it are simple. As seen in Figure 4.1, a virtual fence is a user-drawn arbitrary polygon that is made up of an array with stiffness values for each vertex. According to Figure 4.1, the virtual fences are divided into three zones. Zones 1 and 2 are safe zones, Zone 3 has been designated as a risk zone, and the area outside of these zones is known as an escape zone. The gap between each section is completely adjustable by the user. The default distance between both the safety and warning areas in this study is set at 5 m, and the default distance between the warning and risk areas is set at 5 m as well, taking into account the GPS error and the movement speed of the animal. The virtual fence's control division is built to guarantee that grazing animals are adequately controlled. The stimulation of sound relies on the zone if somehow the animal is in a safe region, as was discussed in the preceding section.



Zone 1: Safe area Zone 2: Warning area Zone 3: Risk area
Fig 4.1 Virtual Fence

Raspberry Pi

The Raspberry Pi Foundation and Broadcom collaborated to create a line of compact single- board computers (SBCs) called Raspberry Pi in the UK. The initial focus of the Raspberry project was to encourage the study of fundamental computer science in classrooms and underdeveloped nations. Because of its inexpensive cost, versatility, and open design, it is frequently utilized in numerous fields, including weather monitoring. Due to its embrace of HDMI and USB devices, it is primarily utilized by electronic and computer hobbyists.

Diagram

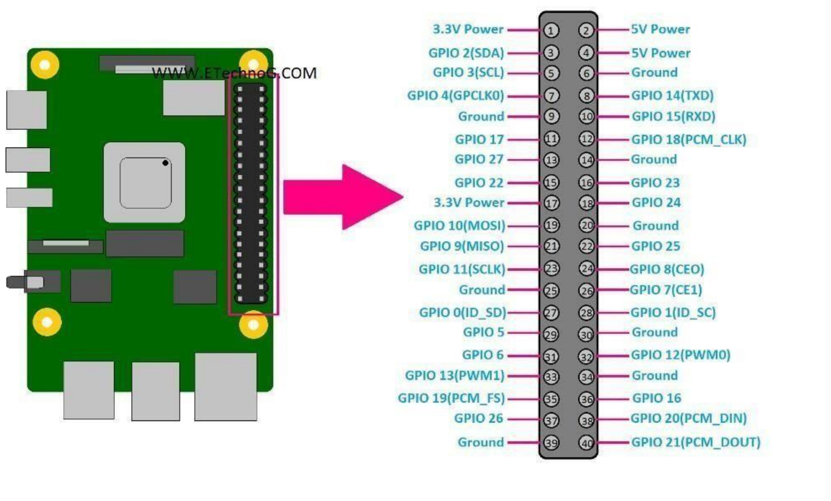


Fig 5.1.2 Raspberry pi

GPS MODULE

Description

The GPS uses signals from both ground stations on Earth and satellites in orbit to pinpoint a user's location. The GPS receives radio frequency signals that are transmitted by satellites and ground stations. These signals are used by GPS to pinpoint its precise location. There is no need for the GPS to transmit any data. Time stamps indicating the time at which the signals were transmitted are included in the signals that are received from satellites and ground stations. Through the calculation of the time difference between the signal's transmission and reception. A straightforward computation for distance using speed and time can be used to compute the distance between the satellite and the GPS receiver using the speed of the signal. The precise location of the GPS can be triangulated using data from three or more satellites.

Diagram

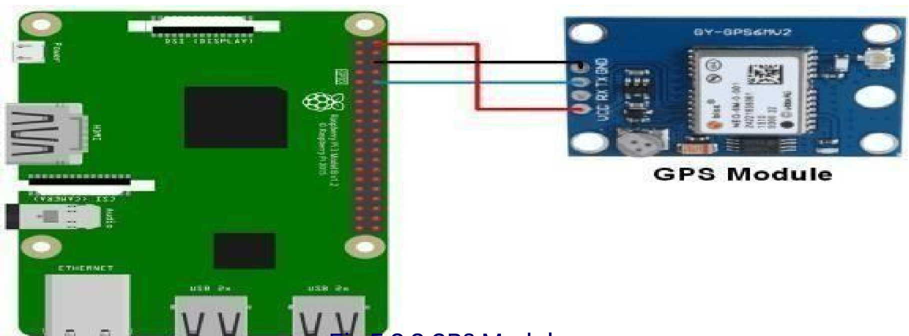


Fig 5.2.2 GPS Module

Vibration Module:
There are many different types of vibration sensors, also known as piezoelectric sensors that are used to measure changes in acceleration, pressure, and vibration in a device or system. Through the miniaturised or MEMS vibrating sensor modules that are widely used today, it can be utilized in conjunction with an Arduino or Raspberry Pi. This makes it possible to quickly fulfill vibration sensor applications in a smaller and more affordable form factor.

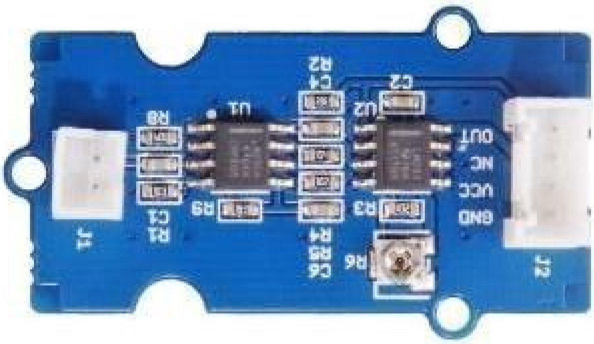


Fig 5.3 Vibration module

V. IMPLEMENTATION

Fig 5.1 explains how the proposed system works here the inputs are received from bands then it sends data from the sensor to the cloud. Then live monitoring will be done with a smartphone. If a net connection is not available, the system will notify for enabling connection.

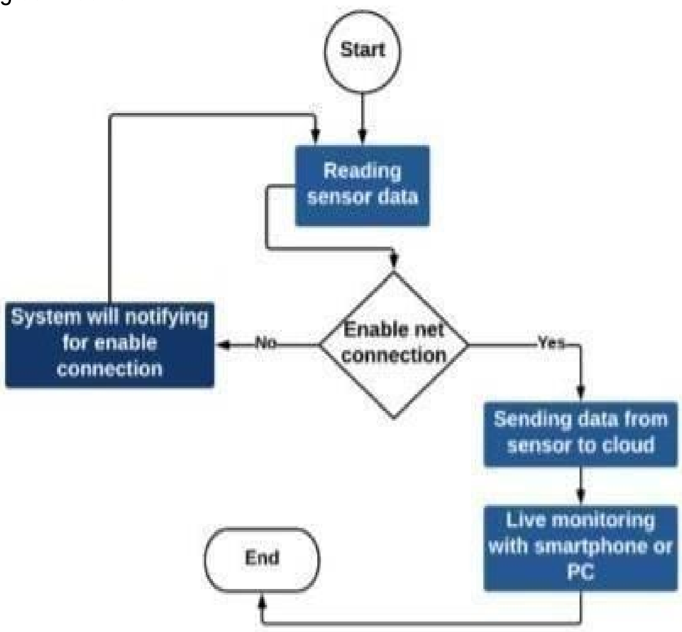


Fig 5.4 Data flow diagram

VI. CONCLUSION

The simulator described in this research is built on potential fields and stateful animal models, and it uses field observations and track data from a smart collar to determine its parameters. By thinking about how audio and electrical shocker stimuli affect the animal but have doubts because of habit. Additionally, take into account the possibility of sparingly applying electrical shock stimulus because of idea struck us that it would be harsh if we applied it frequently. Instead, distinct audio cues have been employed to frighten and manage animals by splitting the virtual fence into three zones: a safe region, a warning area, and a risk area. To prevent animals from becoming accustomed to the same sounds, users can manually choose the audio set from the list. Even before it learned to link the aural cue with the electrical stimulus, the animal in this investigation had a low chance at getting an electrical stimulus (20%). Animals were fast to cross the site when the virtual fence was removed on the last two days so they could visit the other side of the experimental area. This shows that the animals were responding to cues rather than the virtual fence's location. An aural warning was delivered to a leader animal in this investigation before the use of an electrical stimulus. The electrical stimulus was only used if the leader animal did not turn or halt in the danger zone on the audio. The animal interacted with the fence frequently and was keen on spending time near the location of the virtual fence, yet it was nevertheless successfully contained to a particular area of the paddock.

Future iterations of the smart collars would probably have been using the same modules as those already in use, together with a long-lasting battery and waterproof shell, to ensure its security in all conditions.

REFERENCE

1. Anderson, D. and Hale, C. 2001. Animal control system using global positioning and instrumental animal conditioning Technical Report US Patent 6,232,880, USDA.
2. Zack Butler, Peter Corke, Ron Peterson & Danie l Rus, "virtual fencing for controlling cows", proceeding of 2004 IEEE.
3. L. Nóbrega, A. Tavares, A. Cardoso, and P. Gonçalves, “Animal monitoring based on IoT technologies,” in Proc. of the 2018 IoT Vertical and Topical Summit on Agriculture - Tuscany (IOT Tuscany). 2018. May pp. 1-5.
4. D.M. Anderson, “Virtual fencing - past, present and future", The Rangeland Journal, vol. 29, pp. 65-78, 200.
5. Anderson, D.M.; Hale, C.S. Animal Control System Using Global Positioning and Instrumental Animal Conditioning. U.S. Patent 6,232,880, 15 May 2001.
6. Prashant Kharat and Jayashree Kharat, "Wireless Intrusion Detection System Using Wireless Sensor Network: A Conceptual Framework," International Journal of Electronics and Electrical Engineering Vol. 2, No. 2, June 2014.