ISSN:2231-0711
www.ijcset.net

Development of Virtual Fence
(A Technology for Controlling Animals)

Indrajeet Ghorpade, B.Persis Urbana Ivy
VIT University, Vellore-632014
jeetghorpade@gmail.com
prssivy454@gmail.com

ABSTRACT :-Animal Husbandry has become an important source of income for millions of rural families and has taken an important role in providing employment and income generating opportunity. Indian Dairying shows few of the best Statistics. It ranks first with 185.2 million cattle & 97.9 million buffaloes accounting for about 51 percent of Asia's and about 19 per cent of world's bovine population. It also ranks first in milk production with a production of 100.9 million tons in 2006-07. Today, India has the world's largest dairy herd, and is second only to the United States in milk production. Managing this immense number of animals is not an easy task. Often herds of cattle cross boundaries, lose direction and encroach into restricted areas. Also overgrazing is causing a serious problem of soil erosion. Construction of a real physical fence is too expensive and due to large and variable areas of grass lands, it is difficult too.
In order to overcome these shortcomings of traditional ways, we design a Virtual Fence in order to control and manage animals. This is done using sound and electrical stimulations.

I. INTRODUCTION:

Intensive labour activity is involved in herding. Animals graze over large areas of pastures separated by fences. Often they are shifted to other pastures in order to avoid overgrazing at one location. This activity requires a lot of man power so there is a need for a revolution using technology, communication and automation. Large sums of money and time is spent by farmers on maintenance and building of these fences. Harsh climatic conditions also pose a problem for herding.

To overcome these limitations, we develop virtual fences using sensor networks and displacement analysis. With the help of GPS localization, wireless networking and motion sensing a virtual fence can be achieved.

Animals are given smart collars comprising of sound generating device, position tracking device and wireless networking device. When the animals approach the boundary, a sound stimulus is sent in order to keep the animal so as to keep it within its safe area. This sound is inversely proportional to the distance of the animal from the boundary. Experiments have proved that animals respond to different sounds in unique ways. A set of sounds like barking of a dog or roaring of a tiger can scare cows, buffalos and other domestic animals. These can be rotated used to move the grazing animals away from the fences. Also the fences can be shifted by changing the co-ordinated of the area, however, at a steady speed in order to avoid unpredictable behaviour of the animal. In cases where areas are restricted (e.g. borders between two nations), if the animal moves too close to the fence, an electric stimulus can also be applied to guide it.

II. RELATED WORK:

Electric fences are most widely in use today. A barrier that uses electric shocks to deter animals or people from crossing a boundary is called an electric fence. The voltage of the shock is such that it may cause pain, uncomforting or even death based on its purpose. Today electric fencing is mostly used for agricultural fencing and other forms of animal control purposes. It is also used for security purposes in sensitive areas as well as outside wildlife sanctuaries in order to protect villagers and also to avoid poaching or illegal cutting of trees.

Electric fences produce an electrical circuit when touched by a person or animal. A component called a power energizer converts power into a brief high voltage pulse. An electrical pulse is released by one terminal of the power energizer along a connected bare wire. The other terminal is earthed. When an animal comes in contact with this, a circuit is completed thus resulting in a painful and uncomfortable shock. Depending on the voltage, degree of contact and contact with ground, the effects of the shock vary.

This method is not the most efficient since poorly designed or badly maintained electric fences can create sufficient electromagnetic interference to cause problems for nearby telephone, radio, and television reception - and also cause a problem for dial-up Internet users in some rural areas.

Another method used for fencing is *Sensor based fence.* Sensors are fixed at the boundaries of the field which can sense an animal or an object coming close to it (e.g. the working of automated doors in malls). On receiving this signal, it generates sound that tries to drive back the animal. This method creates a fence which is almost virtual in nature and has been used in European farmlands.

However both the methods specified above have a limitation that the fence is static in nature. If the boundaries are required to be relocated, in Electric fence, a whole new wiring needs to be done while in the latter method all the sensors need to be repositioned. This requires a lot of time, expertise manpower and money.

Hence we develop a new technique that has all the advantages of the Sensor based fence and which overcomes its limitation. The *Virtual fence* can be moved with the desired speed in the desired direction. The need to move any physical components is totally eliminated.

III. PROPOSED WORK :

The Virtual fence consists of mainly the Smart collar, Global Positioning System and the Central Control System.

A. The Smart Collar hardware comprises:

The computer with a 206MHz Intel StrongArm processor, 64MB of RAM, with an additional 128MB SD memory card.

It has a serial port and stereo sound port. A Socket brand 802.11 compact flash card provides a wireless network connection. An eTrex GPS unit is connected to the serial port. A small Smokey brand guitar amplifier is used to reproduce sounds from the audio port.

A volume of 90 to 100dB volume can be produced by the audio amplifier and the speaker at a one foot range, depending on the nature of the sound.

A laptop computer is used as a base station for sending commands to the collars.

The parts of the collar are enclosed in a plastic case in order to protect it from water.

Counter-weights are attached on bottom sides so as to keep the collar in position.

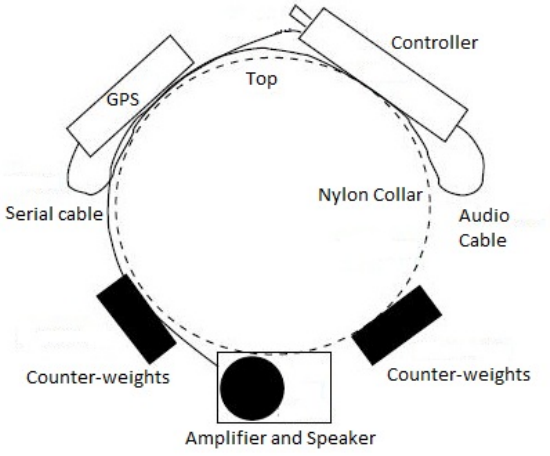

fig (1)

Components of the collar

B. The Software requirements are as follows:

1) Fences and Sounds: A fence is composed of a closed curve of co-ordinates plotted on the earth surface and velocity. These co-ordinates determine the area of the pasture and thus restrict the moment of animals within the boundaries. A fence can be moved by making changes in the co-ordinates and specifying a velocity. Rapid moment of a fence causes the animals to behave in an undesired way which is not expected, for this the velocity should be set such that it does not shock the grazing animal. The co-ordinates change with the given velocity thus shifting the fence to another area. In this manner, over-grazing and problems related to it are averted.

On the detection that the animal is crossing or nearing the boundary, a sound is triggered. Format of the sound is WAV and a wide range of sounds stores can be played. Sounds that can be used are cow-moo, cymbal-loop, dog-bark, lion roar, storm-thunder, wolf-howl, high-pitch-squeal and so on.

The sound can be controlled on a 0 to 100% scale. All fences use the currently selected sound and volume, which can be changed without redefining the fences.

2) Message Handling: Wireless network is used to control the software. This allows messages to be sent locally. All WiFi messages are multihop, being forwarded once by each collar, to improve range and connectivity within the herd. There are two message channels, one outgoing from a base station and one incoming to the base station. The outgoing channel is used for defining fences, manually triggering sounds, setting sound type and volume. The incoming channel carries “Alive” messages indicating a collar is active, and acknowledgment messages for receipt and proper interpretation of messages.

C. Working:

Various sounds and volume levels are set for various distances from the fence. The volume of sound is inversely proportional to the distance of the animal from the fence.

The GPS finds the position of the animal at the given time instance ‘t’. Then the distance of the animal is calculated relative to the fence ‘d'_r . This distance is continuously subtracted from the safe distance ‘d_s’ Safe distance is the distance upto which the animal can move safely within the boundary, within this distance, no sound stimulations are produced.

Thus the resulting distance is: $d(t) = d_s - d_r$

If d(t) is approaching zero and is positive means that the animal is nearing the fence and thus sound is triggered to guide the animal.

If d(t) becomes negative, the animal has crossed the safe distance and is at the fence about to cross it if not stopped. At this point, electric stimulations are applied to stop the animal from moving any further thus maintaining its position within the fence.

IV. CONCLUSION AND FUTURE WORK :

Virtual fences are of great use since they eliminate the need of large manpower for herding with the help of technological advancements. Also the dynamic nature of the fence allows it to be moved from one point to another unlike the conventional fences which are static. Safety of cattle is ensured where the pastures are of a large area and near territorial boundaries. In future, more detailed study of Animal understanding and reaction to various sounds as well as better positioning

systems can help to efficiently implement the idea of virtual fencing. New improved algorithms can be developed for distance calculation thus giving better result than the current system.

V. ACKNOWLEDGMENT

The author would like to thank Prof.Persis Urbana Ivy B. for inspiring to think about this problem, continuous guidance and for a great technical insight.

REFERENCES :

[1] http://en.wikipedia.org/wiki/Electric_fence

[2] D.M. Anderson, “Virtual fencing - past, present and future", The Rangeland Journal, vol. 29, pp. 65-78, 2007.

[3]M. F. WallisDeVries, J. P. Bakker, and S. E. Van Wieren (Eds),

“Grazing an Conservation Management,” Kluwer Academic Publishers, Dordrecht, 1998.

[4] http://www.seaworld.org/animal-info/sound-library