"DESIGN AND IMPLEMENTATION OF VIRTUAL FENCING USING RF MODULE"

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ABSTRACT: Protecting biotopes and maintaining biodiversity are the ecological aims highlighted in European policies[2]. Current grazing systems are confronted with myriad of challenges which demands new fencing technologies. Hence a new technology is proposed based on RF module called "Virtual Fencing". The system alerts the main object* whenever it crosses the virtual fence and also shows the object number which has crossed the fence. Several benefits can be reaped from these Technology based on fencing(virtual fencing) like enhanced ecological management, reduction in human efforts by turning manual labour into cognitive labour & thus improving the life-style of livestock managers[1]. Essence of using the advance fencing technique is to reduce cost. Bringing more flexibility in fencing this new system could lead to more precise management of grazing in protected zones and allows for environmental renovation of wild areas. However despite many patents been registered; only very few products are available in the market.

Keywords: virtual fencing, cost, RF module, Ecological management.

1. INTRODUCTION

Herding is very labour intensive activity. Animals need to be gauged & herded frequently between paddocks to prevent overgrazing of any pasture[1] There are various fencing techniques viz conventional fencing, electric fencing which have been devised for controlling the animals within a boundary[3]. But conventional fencing has some limitations, e.g. the missing flexibility and the labour costs to erect. This limitation paved the way for virtual fencing because biggest advantage of virtual fencing lies in the fact that it enables the people to manage their grazing live stocks from a distant place without even physically present in the field.So in the quest of finding a cost effective solution for the manual work (herding), a secondary study was carried out i.e virtual fencing which can be defined as a structure serving as an enclosure, a barrier, or a boundary without a physical barrier. The concept of virtual fencing finds its place in many discussions on livestock management and different approaches have been proposed for the development of virtual fencing which can be divided into three categories: first, to contain animals in a defined area or vice-versa using devices that are animal-borne; second, to contain animals without mounting a device on the animal; and third, keeping animals apart with a moving fence line or using a virtual fence as a remote gathering device[3]. However, they all have in common the fact that the system uses no physical barrier on the landscape The concept of virtual fencing is more imperative to the people like stockpersons, scientists and nature conservationists which manage free-ranging animals[5]. The term virtual fence seems to be used in a very broad sense and different concepts of its application exist. However, the aim of this paper is to give another method i.e using RF module for virtual fencing technique because it is suitable for long range applications and it reduces the cost, looking at the early and recent developments of the technology and the different existing concepts.

2. OPERATING PRINCIPLE

A virtual fence can be defined as a structure serving as an enclosure or a boundary without a physical barrier [the free dictionary 2010]. So create a hidden fencing has been created using RF transmitter at one end and whenever object (animal) tried to cross the range of transmitter, system will alert the animal and also shows which object (number) has crossed the fence. In addition, it can also

Object*: we can use any animal like cow or dog, here we have used a moving car for our experiment

use the electric stimuli but it does not seem to be ethically accepted when discussing the topic with some stakeholders, scientists and the public. The electric shock used as an aversive stimulus can have animal welfare implications, e.g. when repeated electric stimuli occur due to faulty collars, or the animals do not get a chance to learn before they get a shock[8].So according to animals welfare standards only the audio warning sounds is used in this system. Various audio sounds like car-crash, dog-bark, lion tiger, and wildcat etc. So this whole project is based upon RF module using microcontroller as shown in fig 1 below:

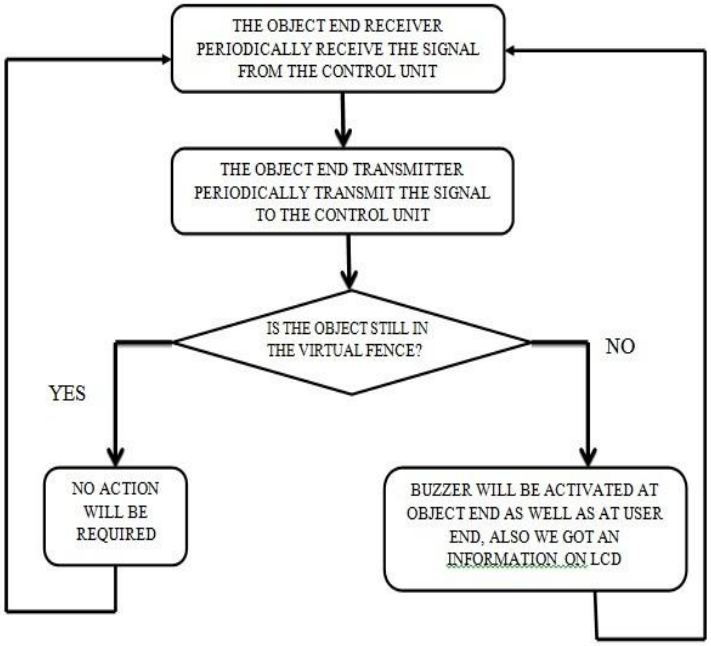

Fig: 1 Flow chart of virtual fencing using RF Module.

3. SYSTEM DESCRIPTION

Whole System can be divide in six modules and below is the details description of each module.

3.1 Control Unit

This control unit is the heart of the hardware of virtual fencing using RF module.

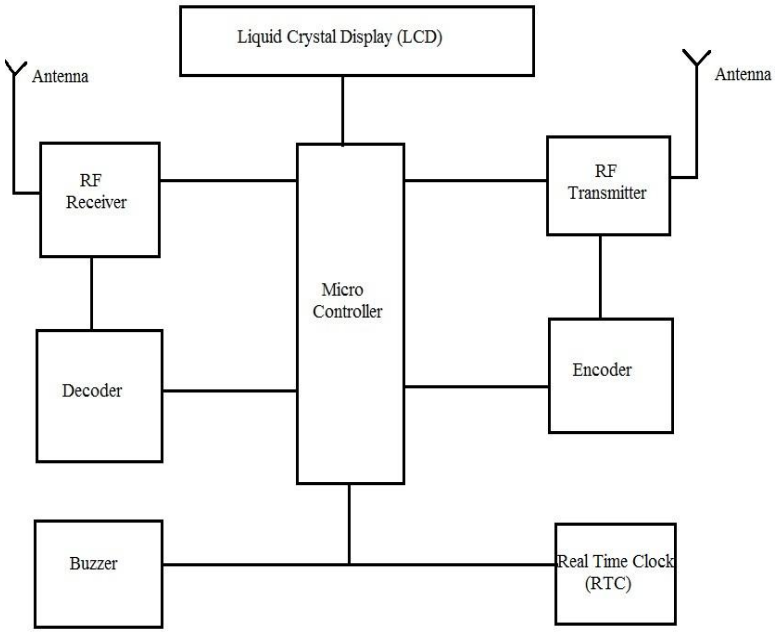

Fig:2 Block Diagram of Control Unit

As shown in fig:2 control unit consist of microcontroller, LCD, Buzzer ,Encoder ,Decoder and discrete components which will send the data (same) to each receiver mounted on the animal end i.e called electronic collar. Whenever any animal crosses the predefined

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range of fencing, the buzzer will be activated and we will receive information about the particular cow on LCD connected to the microcontroller and Range of the field can be fixed by selecting appropriate RF module of particular frequency.

3.2 Liquid Crystal Display

A Liquid crystal display is interfaced to microcontroller unit & it is used to display the required information like which cow is inside/outside the fence with the time etc.

3.3 Real Time Clock

In this Project DS1307 Serial Real Time clock is used for giving the information of date and time whenever any of the animal try to cross the fence. DS 1307 have 56 bytes RAM. Address and data are serially transferred by 2-wire, bi-directional bus. The clock/calendar provides seconds, minutes, hours, day, date, month, and year information. It also provides Leap Year information. The DS1307 has a built-in power sense circuit that detects power failures and automatically switches to the battery supply.

3.4 Encoder/Decoder

The RF module is often used along with a pair of encoder/decoder. The encoder is used for encoding parallel data for transmission feed while reception is decoded by a decoder. HT12E-HT12D etc. are some commonly used encoder/decoder pair ICs.

3.5 RF Module

The RF module operates at Radio Frequency which varies between 30 kHz & 300 GHz. Transmission through RF is better than IR (infrared) because it is suitable for long range applications. RF signals can also travel even when there is an obstruction between transmitter & receiver and that's the reason it is more strong and reliable. The RF module comprises of a RF Transmitter and RF Receiver pair which operates at a frequency of 434 MHz**.** An RF transmitter receives serial data and transmits it wirelessly through RF using its antenna connected at pin4. The transmission occurs at the rate of 1Kbps - 10Kbps. Transmitted data is received by an RF receiver operating at the same frequency as that of the transmitter.

3.5. Electronic collar

As shown in fig 3, Electronic collar consist of transmitter and receiver, buzzer & discrete components which are mounted on the cow neck to receive data from the control unit. Whenever animal tries to cross the area it will transmit the data to control unit and buzzer will be activated at both the end i.e at user as well as at animal end & will continue buzzing till the animal has not come back in a predefined area. Packed electronic collar is shown in the fig: 4. It should be placed very carefully so that it doesn't fell down or disturbed during grazing & hence will not lead to wrong information .The best position is above the neck of the animal as shown in fig:5. It must have various features like flexibility, portable light weight, tightly packed etc.

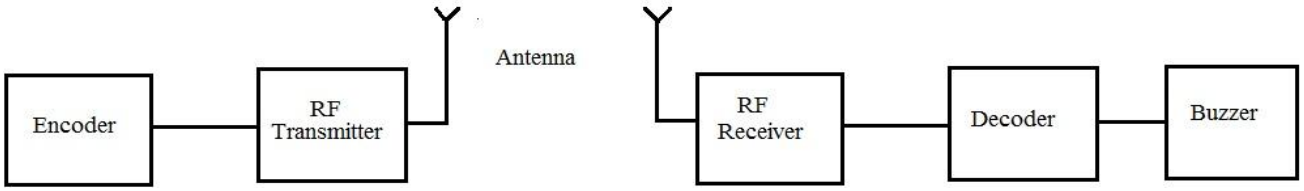

Fig:3 Block Diagram of Electronic Collar

Fig: 4 Packed Electronic Collar[2]

Fig: 5 Cow with Electronic Collar[7]

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4. Result

Fig:6 shows the prototype modal of virtual fencing using RF module

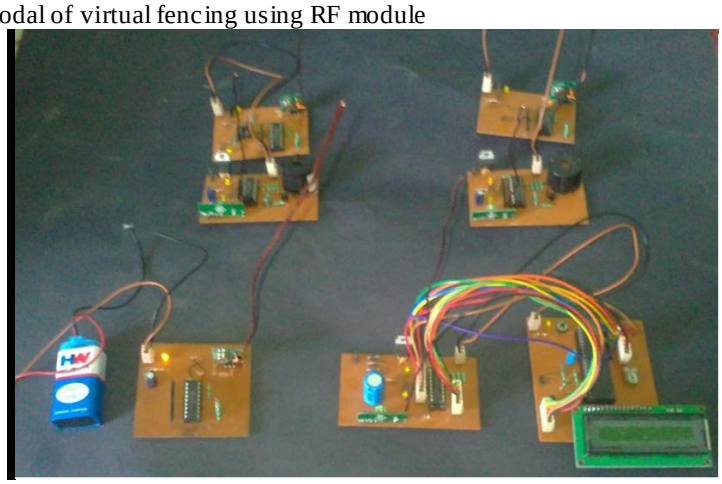
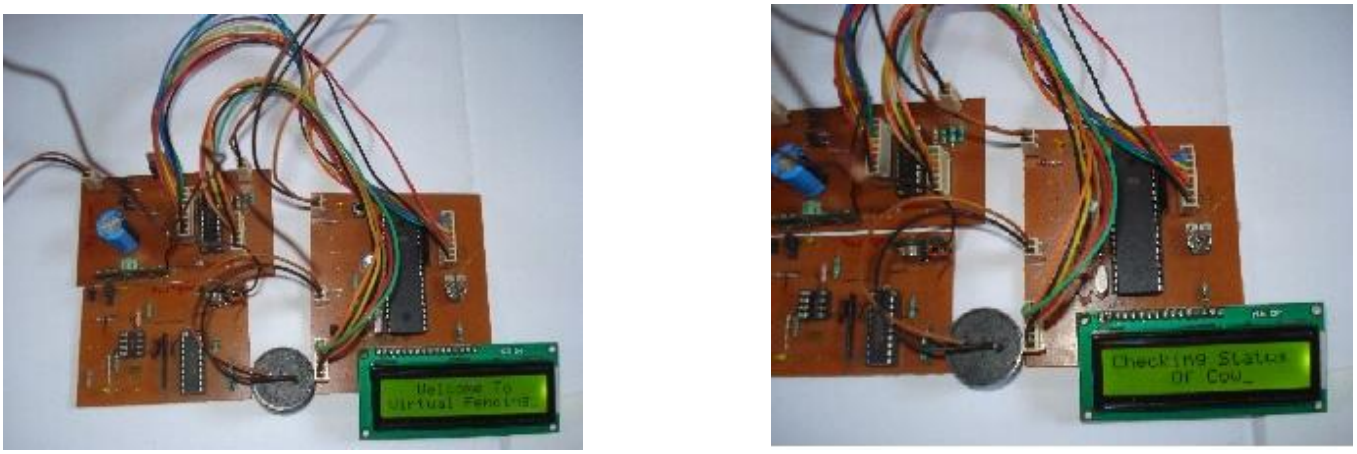


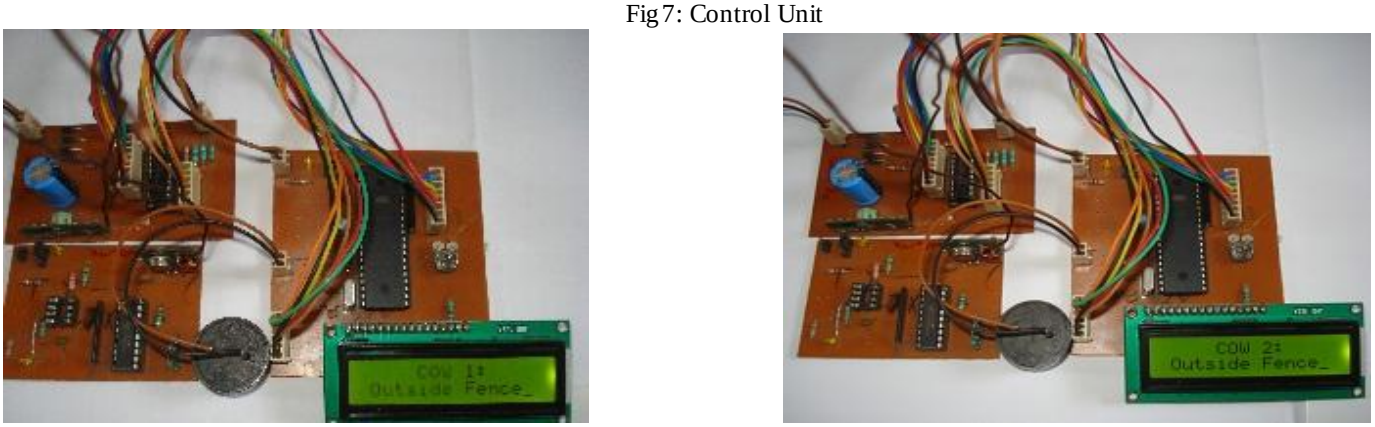
Fig:6 prototype modal of virtual fencing using RF module

Fig:7 shows the control module & continuously monitoring of the status of cows has been done and getting information on LCD whether cow was outside or inside the fence as shown in fig:8 LCD showing cow1 :outside side fence and cow 2: outside fence means both the cows has crossed the range and suddenly buzzer has been activated and got a display on LCD.we have used moving car for our experiment. As shown in fig:9; cow2:inside fence it means cow 2 has been in the predefined range.



(a) (b)

Fig 7: Control Unit



(a) (b)

Fig 8: LCD showing outside fence

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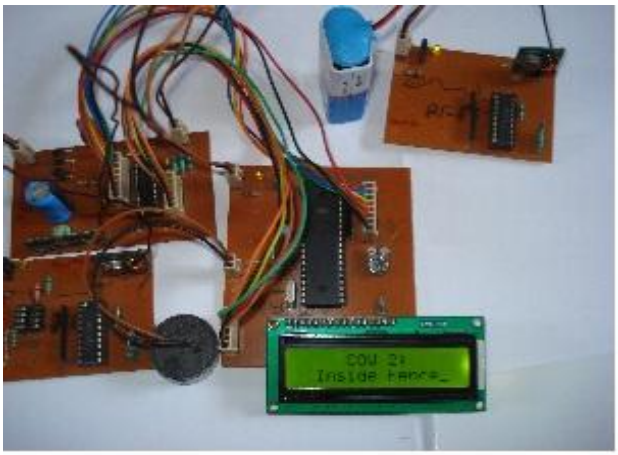

Fig 9 :LCD showing Inside fence

5. COMPARISON BETWEEN VARIOUS FENCING TECHNIQUES:

On the basis of previous technology and proposed technology a comparison has been given in below Table:1 which summarizes the different features of the all the fencing technique:

FEATURES	CONVENTIONAL FENCING	ELECTRIC FENCING	VIRTUAL FENCING USING GPS	VIRTUAL FENCING USING RF TRANSCEIVER
FLEXIBLE	Not flexible	Less flexible	most flexible	more flexible.
MAINTENANCE	Expensive to maintain	High maintainers, earthling and regularly checked is required	More expensive.	Less expensive.
SAFETY	Can injure wildlife and livestock	Prone to accidental injury if the animals caught up in electric current.	Least accidents prone.	Least accidents prone.
COST	High cost	Medium cost	Less cost	cheapest
VISIBILITY	visible for people	visible for people	Not visible for people	Not visible for people
APPLICABILITY	Beneficial in the fields adjacent to road.	Not applicable in far flung areas.	Not applicable wherever satellite connectivity is not present.	Most applicable.

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6. Conclusion

Technology has given big impetus to the fencing technique. Inspite of some challenges a virtual fencing seems to be the future of fencing with technology further bolstering its usage. It has lots of benefits for the farmer for grazing their animals and also a cost effective and does not require a lot of labour.

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