

ULTRASOUND BOOSTER DESIGN AND IMPLEMENTATION FOR ELECTRONIC PEST CONTROL

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Abstract

In this work, an ultrasound booster was designed to increase the effective area of coverage of an existing stand-alone ultrasound pest control device designed to deter weaver bird away from farms. It is a five-segment device, each consisting of a preamplifier, power amplifier and an ultrasonic transducer section. It receives raw ultrasound signal generated by a stand-alone ultrasound device as input, processes and transmits it via its entire segments, resulting in a 360° horizontal spread and a bottom boost. Implementation and testing reveals that, the effective coverage area of the stand-alone ultrasound pest control device was doubled with the aid of the ultrasound booster.

Keywords: Ultrasound, Integrated circuit (IC), ultrasound booster unit, stand-alone unit, weaver birds

Introduction

Ultrasound has a character of being inaudible to human ear but can be audible to certain animals such as bat, birds, insect and rodents (Cancel, 1998, Jones & Waters, 2000, Mann, 2001). When ultrasound is generated in an environment, such animals keep away from the vicinity (Brouwer et al., 1999). This idea has been applied in pest control with some level of success (Hangiandreou, 2003). In a previous work, an ultrasound pest control device was designed to improve the effectiveness of this method (Ibrahim et al., 2013a; Ibrahim et al., 2017). The said device was pest specific and environmental specific in the sense that, it targets only weaver birds in an endemic area of North central Nigeria (Ibrahim et al., 2016). Upon implementation and testing, it generates and transmit ultrasound of specific frequencies (25 kHz and 35 kHz) identified to be effective in repelling weaver birds (Ibrahim, 2015). In addition, the device when instructed is able to broadcast audio sounds of identified weaver birds predators through a mega phone in order to fortify it against habituation. However, one of the challenges encountered when the stand-alone device was deployed was in terms of its reach, as pests keep away from crops closer to the device and feeds on distant crops. The reason for this observation is because ultrasound is a short ranger (Berke, 2002), as it is easily attenuated by intervening media. As a way out of this quagmire, ultrasound booster was conceived. An ultrasound pest control booster is a device that is used to improve the signal strength of an electronically generated ultrasound for the purpose of pest control (Ibrahim, 2015). In this design concept, raw ultrasonic signal is transferred from a stand-alone ultrasound generator to a remote station, here referred to as a booster location where it is processed and transmitted within the location with a 360° horizontal spread and a bottom boost. The aim of this work is to enhance the area of coverage of the stand-alone ultrasound pest control device through appropriate low-cost booster design.

Methodology

Circuit Design

The block schematic of the design concept is shown in Figure 1.