

# ENHANCING ECONOMIC PRODUCTIVITY OF UPLAND RICE IN EKITI STATE THROUGH A FREQUENCY SWEEP AND MANUAL FREQUENCY-SELECT ULTRASONIC BIRD PEST CONTROL DEVICE

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## ABSTRACT

The economic Productivity of upland rice in Ekiti State is threatened by weaver bird pest infestation. In this work, the outcome of an intensive field survey consisting of ultrasonic broadcast was used to generate design considerations for an ultrasound device designed to scare weaver birds away from rice farms. The device which transmits ultrasound signal at 20, 25, 35 and 45 kHz has two modes of operation: the auto-frequency mode, which is able to sweep between all available frequencies at fifteen seconds interval and the manual frequency-select mode, which is able to switch between selected frequencies of interest at same interval. The design comprises of the power supply, oscillator, frequency selection, amplification, microcontroller, LCD and the ultrasonic transducer sections along with their respective specifications, design calculations and circuit diagrams. The design which is fortified to delay habituation when implemented will guarantee reasonable horizontal ultrasound spread to deter weaver birds away from rice farms, thereby maximizing the productivity of upland rice in Ekiti State.

**Keywords:** Design consideration, integrated circuit (IC), Ultrasound, weaver birds.

## 1. Introduction

Ekiti State, south-west Nigeria is known for the cultivation of arable crops such as rice, yam, cowpea and cassava to mention just a few (Adeboboye, 2017). The main occupation of the people is agriculture and it provides income and employment for more than 75% of the people. The food sufficiency in the area is however being threatened by the activities of pests, prominent is that of the notorious weaver birds (*Ploceus cucullatus*) attacking rice farms (Bright, 1988, Bright *et al.*, 2007). Rice (*Oryza sativa*), is one of the most staple food in several homes of Ekiti people (Akande, 2003, and USAID, 2008). Available pest control methods in the area include: use of scarecrow, tapes, mechanical devices, hunting, screaming, chemicals and juju to mention just a few (Bright *et al.*, 2007 and Bright *et al.*, 2009). All these control methods has proved to be less effective due to habituation. In this research, an attempt was made to solve the weaver bird pest problem of the area electronically using ultrasound as a scaring parameter.

## 2. Literature Review

In line with earlier recommendation (Ibrahim *et al.*, 2013), that ultrasonic pest control devices should not be deployed to location without an extensive field survey carried out to determine the effective ultrasonic frequency, crop stage(s) prone to attack, period of the year and period of the day of attack and other interesting factors needed to formulate effective design parameters. A robust field studies was conducted in Niger State, Nigeria (Ibrahim, 2015). The study among others carried out an ultrasonic broadcast using a collection of independent equipment in weaver birds infected farms. Analysis of data collected at tree homes pointed to the put-to-flight frequency and the stay-away frequency for weaver birds as 35 kHz respectively. Also of interest is their equivalent in farms determined to be 25 kHz (Ibrahim *et al.*, 2016). The outcome of the survey have been adopted in addition to other studies in the study area as the preliminary study which served as precursor for the development of specific design consideration for an ultrasonic device that effectively tackled the weaver bird pest menace in the area. The bird pest problem bedeviling rice farms in neighboring Ekiti State,