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Development and Evaluation of a Remote Controlled Bird Scarer for Rice Farms in Igbemo-Ekiti, Nigeria

[1*]Ajewole, P. O. and [2]Oladimeji, E. A.

[1]Department of Agricultural and Bio-Environmental Engineering, The Federal Polytechnic, Ado-Ekiti

[2]Department of Mechanical Engineering, The Federal Polytechnic, Ado-Ekiti

* Corresponding author: ajewole_po@fedpolyado.edu.ng, +2347068675164

Abstract

Different methods have been employed to keep birds away from rice farms. A remote controlled bird scarer was developed in this project work. It is an ultrasonic scaring technique which involves an alarm system for scaring birds in cereal crops. The device consists of an infrared receiver sensor, a remote control, and an automatic battery charging unit, a 12 volts battery and horns. The battery powers the infrared remote control receiver which receives an infrared signal from a remote control device and then triggers an alarm. The device can produce different continuous sounds at increasing rate. An initial testing of the device showed that it emits sound of 120dBA at the range of 10m. The device was evaluated at five systematically selected farms in Igbemo-Ekiti between the cropping seasons of 2021 and 2022. The evaluation exercise showed the use of the device increased the annual production of the farmer with an average of 7.7% increase. It is believed that the use of the device can lead to increased production and further improvement on the device can revolutionize production of rice in Igbemo-Ekiti.

Keywords: Rice, Scarer, Remote-controlled, Igbemo,

Introduction

In Nigeria, Agriculture is mainly the source of income with majority of people in rural areas engaged in agriculture (Omoroiguwa et al, 2014). Apart from maize, rice is one of the most grown grain crops in Nigeria. Nigeria holds the leading position as the primary rice producer in West Africa, contributing significantly to an average annual production of 3.2 million tons of paddy rice and 2 million tons of milled rice (Daramola, 2005). Rice is the sixth largest crop produced in Nigeria after sorghum, millet, cowpea, cassava and yam, and it can also be ranked first as the major staple food in most homes (Longtau, 2003). Though Nigeria stands out as the largest consumer of rice in West Africa, with its increasing demand estimated at 4.1 million tons in 2002, more than half of rice consumed in the country is obtained through importation from countries such as Thailand. In July 2015, following the announcement by the Nigerian Federal Government regarding its intention to prohibit the importation of rice, there was a noticeable surge in the growth of domestic rice production in Nigeria, accompanied by an uptick in the demand for rice produced within the country (Adeite, 2023). Ekiti state which is a state in south west Nigeria ranked third among the states producing rice in Nigeria with average annual production of 1.5 million MT compared to Kebbi, Jigawa, and Kano states with annual production of 3.5, 2.1 and 1.6 million MT respectively (Commodity Port, 2022). Igbemo-Ekiti is a town in Irepodun/Ifelodun Local Government Area by the West of Ado-Ekiti, the state capital of Ekiti State which is characterized for its intensive cultivation, processing and production of a brand of rice usually called Igbemo (Basorun, 2012).

The importance of achieving a sustainable increase in rice production cannot be overstated, as highlighted by Nguyen and Ferrero in 2006 (Nguyen and Ferrero, 2006). This pressing need arises from the well-established fact that the demand for rice consumption significantly surpasses the local rice production levels in both Nigeria and the global context (FAO, 2001; Okpiliya, 2003). The effort of local producers has not yielded much result partly due to the problem of birds attach on rice farms. Birds attack has been the most worrisome problems that local rice farmers have been grappling with for years. This results in low harvest and consequently discourages most young farmers. This has necessitated significant rice imports from foreign countries to bridge the gap in rice supply within the country, as noted by Fakayode in 2009 (Fakayode, 2009). This importation trend has not only depleted a significant portion of Nigeria's foreign exchange earnings but has also led to a notable surge in rice smuggling across the nation's land borders, notably at Idi-Iroko and Seme (Osanyinlusi and Adenegan, 2016).

Vertebrate pests, such as rodents and birds, pose significant challenges in all rice cultivation areas and they are the most difficult to control when compared with other pests such as insects which can be easily controlled with chemical methods. Common avian pests that attack rice farms in Nigeria include weavers and quelea birds (Longtau, 2003). In Igbemo-Ekiti, some farmers do hire labourers to drive birds from farms by making noise and moving round the farm, while some use scare crows. These methods have not been effective as there is much pressure to increase cultivated area where these methods of controlling bird pest infestation may not be feasible. Other methods of bird control which have been employed include the use of gas cannons, pyrotechnics, dogs, lasers, raptor models, and balloon. In this work, auditory method of birds deterrent on rice farms is employed by designing a remote-controlled device which transmits different sounds at different frequencies and rate.

2.0 Materials and Method

2.1 Description of the Bird Scarer

The bird scarer designed and constructed in this work consists of the following components:

(1) Pole: it is used to raise the horns (modulated alarm). It is 5mm thickness, 3.5 meters long

(2) Horn: it is used to provide a loud sound on the farm and scare birds away from attacking crops

(3) Transformer: is used to step down the voltage from 220V to required voltage (12volts).

(4) Casing: This is where the circuit device is been housed to protect and make it portable.

(5) Bolt and Nut: This is used to attach or keep the horn in better position.

(6) Cooling Fan: This helps to cool the circuit in case of long time usage.

(7) Fuse: This helps in protecting the device in case of high current

(8) Battery: it is used to store electric current D.C .12volts, 7.2amps

(9) Remote Control: it is used to control the device

(10) Infrared Receiver Sensor: it helps to receive signal sent from the remote control.

(11) Automatic Battery Charging Unit: it is used to charge the battery effectively without over charging.

2.2 Design Consideration

In the process of designing and choosing materials for the device components, the following factors were put into consideration

i. Material Availability: The materials were chosen to suit the device and the components readily available.

ii. Cost: Due to the high cost of materials, the material used will be able to cover 10m range for effectiveness.

iii. Size and Weight: The parts were chosen such that the device can be dismantled and easily carried from one farm to the other

2.3 Electronic Circuit Analysis

The electronic parts consist of the following sections, a remote control receiver circuit panel, a remote control, an automatic battery charger circuit panel, a step down transformer and an electronic modulating horn and a battery. The remote control receiver section is responsible for the switching on and off of the siren with the help of an infrared remote control sensor due to its ability to sense the light that is emitted by an infrared light emitting diode (infrared LED) and only an infrared remote control sensor can sense the light emitted by an infrared LED. When the button is press on the remote control the infrared LED sends a light to the infrared remote control sensor and it will receive it and automatically sends the signal into the panel and it will switch on the device and when the button is pressed on the remote again it, the process is reversed. The device is powered by 12volts battery but once the battery is down, automatic battery charger is introduced to charge the battery when it use plug to power supply 220volts. Step-down transformer is used to step-down the 220V AC to12V, the rectifying diode will convert the 12Volt AC (Alternating Current) to a 12volts DC (Direct Current) so as to be able to charge the battery and prevent the battery from overcharging. The overall circuit diagram and the remote control circuit diagram as shown in Fig. 1 and Fig. 2.

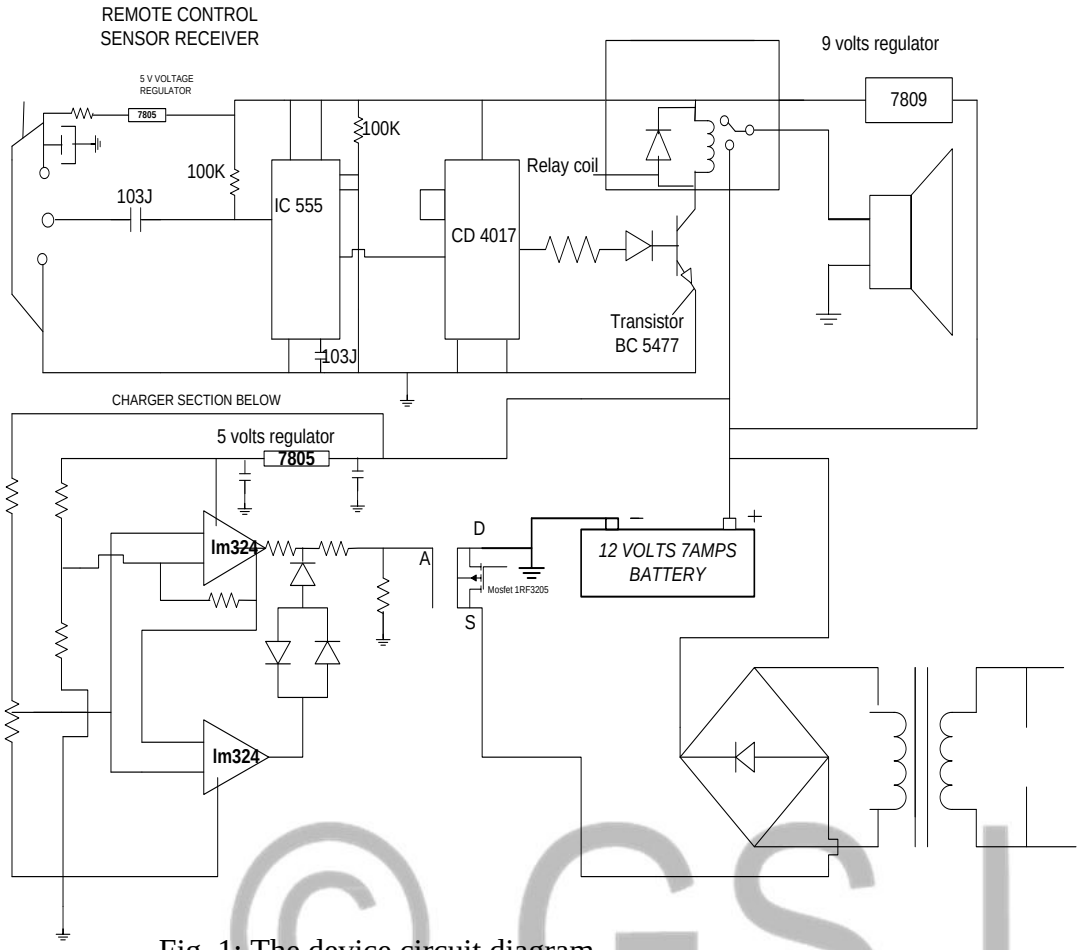

Fig. 1: The device circuit diagram

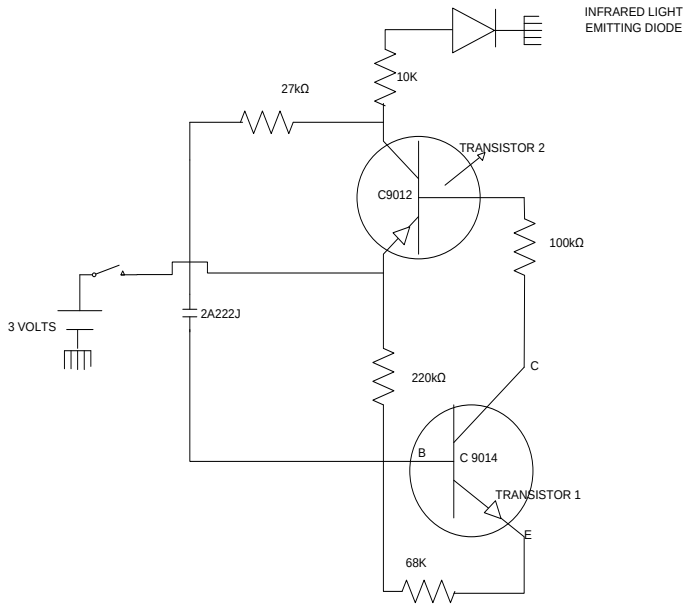

Fig. 2: Remote control circuit diagram

2.4 Assembly and Testing of the Device

Remote control receiver sensor is coupled inside the device together with charging panel, transformer, cooling fan. The remote receiver panel is powered by a 12volts battery and the charger is used to keep the battery voltage at a constant12volts whenever there is power. When the whole instruments were set, the battery was connected to infrared remote control receiver and remote control was used to send infrared signal to the receiver in order to trigger the alarm. The birds reaction change and birds sound was then monitored. The sound of the alarm becomes louder while all the birds flew away. The bird scarer assembled is shown in Fig. 3.

Fig. 3: The assembled bird scarer

2.5 Evaluation of the Device on Igbemo Rice Farms

The device was tested at five systematically selected farms in Igbemo-Ekiti between cropping seasons of 2021 and 2022. The farms were selected based on the acres of land cultivated and the annual production of the farm and those with the largest area of cultivated land were selected for the evaluation. For the cropping of 2022, the bird scarer was deployed and mounted in each of the farms. The farmers were encouraged to always start the device remotely early in the morning when the birds do always invade the farm throughout the milking stage. At the end of the cropping season, the harvest obtained from each farm were measured and compared with

3.0 Result and Discussion

Table 1 shows the harvest obtained in 2022 in each of the farms selected. It was discovered that the harvest yield obtained by the farmers depend on the acreage of land cultivated. Some of the farmers had difficulty in charging the battery of the device due to erratic power supply in the region. This can be improved upon by incorporating solar charging system into the device. The deployment and the use of the device yielded increase in the harvest of the farmers. The increase in yield ranged from 10.78% to 6.46%. The survey carried out after the evaluation shows that all the farmers prefer the continuous use of the device.

Table 1: Data of the farmers selected for the evaluation of the bird scarer

Farms	Acres of Cultivated Land (Acres)	2021 Harvest (kg)	2022 Harvest after using bird scarer (kg)	% Increase in Harvest
A	54	102,000	113,000	10.78
B	46	80,500	89,000	10.56
C	42	78,860	84,700	7.41
D	36	59,400	61,350	3.28
E	27	54,760	58,300	6.46
Average	41	75,104	81,270	7.70

5.0 Conclusion

A remote controlled bird scarer was designed, constructed and evaluated in this study. The bird scarer was deployed at five selected rice farms in Igbemo-Ekiti. The results showed that for the average cultivated land of 41 acres, the bird scarer was able to control bird attacks and increased the farmers' harvest with an average increase of 7.70%.

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