



**FACULTY OF ENGINEERING**

**DEPARTMENT OF CHEMICAL AND PROCESS ENGINEERING**

**FINAL YEAR PROJECT REPORT**

**DESIGN, CONSTRUCTION, AND TESTING OF A NOVEL ROUND THE  
CLOCK SOLAR CROP DRYER WITH WATER RECOVERY:**

**PART 3: THE AIR CIRCULATION SYSTEM OF THE DRYER.**

**BY**

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*A final year project report submitted to the department of Chemical and Process Engineering in partial fulfillment of the requirements for award of a BSc. in Agro-Processing Engineering at Busitema University.*

## ABSTRACT.

This project was about the design, construction, and testing of a novel round-the-clock solar crop dryer with water recovery. The air circulation system of the dryer handled the air circulation system of the dryer. The entire project had other 5 subsystems that were designed and assembled to form the integral novel dryer. The air circulation system could operate as either an open system or a closed system depending on the weather condition. The airflow in the dryer was an open system during the day and a closed system during the night as well as during rainy weather conditions. During the day, the system gained thermal energy from the solar thermal (ST) system while at night, the heat pump subsystem provided the thermal energy required for drying the crops. There was water recovery from the food being dried only during the night given that the air circulation system was an open system during the day. At night, hot air picked up moisture from the drying crops and then forced to condense it by the evaporator before entering the collector. This air thus interacted with systems designed by two other people who supply the heat transport required of the airflow. The water coming out of the dryer is to be collected in such a way that it does not lead to air leakage into the system. The circulation of air was by forced convection by use of a suction DC fan. Open sun drying and dryers that use open-air circulation systems only have a challenge of rehydration of the food at night and in rainy weather respectively from the humid air. Iterative moisture loss and moisture absorption by the crops deteriorate the mouthfeel and quality of the food during its consumption. Therefore, there was a need to develop, design, and construct an air circulation system of the novel solar dryer that allowed both open-air circulations and closed air circulation depending on the time of the day or the weather to achieve efficient air movement in the dryer without reabsorption of moisture in all weather conditions. The study was focused on developing, designing, and fabricating the air circulation system of a novel round-the-clock solar crop dryer. This study aimed to serve medium-sized farmers who could afford to spend about 15 – 25 million Ugandan shillings on a solar crop dryer. The efficiency of the air circulation system was 63.87%. The air supplied by the system was sufficient to cause the desired drying of the food. The movement of air throughout the system was by forced convection.

**Keywords:** air circulation, heated air, airflow, temperature, DC suction fan, downdraft air movement.

## **Declaration**

I **AKIMANZI GLORIA, BU/UG/2017/6**, hereby declare that this report is the work of my hands and this research has never been presented by any person or institution for an academic award.

Signature: .....

Date: ...../...../.....

## **Approval.**

This work has been compiled with guidance and consultation from my supervisor.

**Prof. Kanyarusoke Kant**

Signature.....

Date...../...../.....

## **Dedication.**

I dedicate this report to my family, team members, friends, and my supervisor. May God reward you.

## **Acknowledgment.**

I am very grateful to the Almighty God for the guidance and good health he has provided to me and for enabling me to reach this year of study.

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