

DEVELOPMENT OF A CACAO BEAN CLASSIFICATION
SYSTEM USING IMAGE PROCESSING AND
ARTIFICIAL NEURAL NETWORK

Design Project

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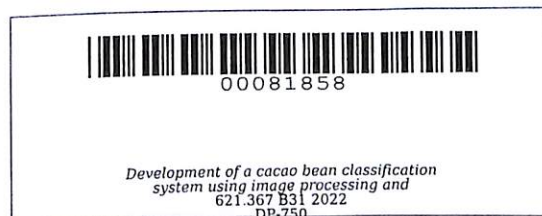
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**DEVELOPMENT OF A CACAO BEAN CLASSIFICATION
SYSTEM USING IMAGE PROCESSING AND
ARTIFICIAL NEURAL NETWORK**

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ABSTRACT

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Using an image processing method and an artificial neural network model, this paper outlines the development of a prototype for identifying the quality of cacao beans based on the color of its interior. The Philippine National Standards for cacao beans were used as the basis for the system's set of guidelines and standards. The prototype was able to automatically determine the classifications of hybrid Trinitario cacao beans cultivated at Dariano Cacao Farm in Silang, which is located in the province of Cavite in the Philippines.

The images employed as the data samples of the project were captured using a camera in a controlled setting. The sample images that have been loaded to the system consisted of 13 cacao beans that were placed in the prototype's sample drawer. Thereafter, the photographs are transferred to the system of the prototype, which then crops each of the 13 cacao beans individually and segments the characteristics of each image based on the RGB values.

Classification experiments on 260 cross-cut hybrid Trinitario cacao beans using the artificial neural network classifier yielded an overall accuracy of 91.65 percent. The findings indicate that the developed image processing technique and the Artificial Neural Network or ANN-based classifier have the potential to be used as an efficient instrument for the purpose of classifying cacao beans.

TABLE OF CONTENTS

	Page
BIOGRAPHICAL DATA.....	iii
ACKNOWLEDGMENT.....	iv
ABSTRACT.....	viii
LIST OF TABLES.....	xi
LIST OF FIGURES.....	xii
LIST OF APPENDICES.....	xiii
INTRODUCTION.....	1
Objectives of the Study.....	3
Significance of the Study.....	4
Time and Place of the Study.....	4
Scope and Limitation of the Study.....	5
Definition of Terms.....	6
REVIEW OF RELATED LITERATURE.....	7
METHODOLOGY.....	13
Conceptual Framework.....	13
Design Considerations.....	15
Materials.....	16
Expected Output.....	19
Training and Deploying the Classifier.....	23
Developing the System Program.....	28
Evaluating the System Performance.....	29
Cost Computation.....	30
RESULTS AND DISCUSSION.....	32

Constructed cacao bean classifier chamber unit.....	32
Trained and deployed ANN classifier model.....	34
Development of program to control the system.....	37
Evaluation of the performance of the system.....	40
SUMMARY, CONCLUSION, AND RECOMMENDATIONS.....	45
Summary.....	45
Conclusion.....	46
Recommendations.....	47
REFERENCES.....	48
APPENDICES.....	52

LIST OF TABLES

Table		Page
1	The grading for fermented cacao beans.....	10
2	Input-Process-Output Map of the study.....	14
3	The sample images for feature extraction of cacao beans.....	24
4	Overall costs of the study.....	31
5	The parameters utilized in the FFBPANN.....	35
6	Data results acquired with five batches of normal beans.....	41
7	Data results acquired with five batches of moldy beans.....	41
8	Data results acquired with five batches of slaty beans.....	42
9	Data results acquired with five batches of damage beans.....	42
10	Summary of data results acquired for all of the classes in 10 trials.....	43
11	Time taken results of the 10 trials.....	44

LIST OF FIGURES

Figure		Page
1	Overall system architecture.....	14
2	The external view of the expected output.....	20
3	The internal view of the expected output.....	21
4	Block diagram of the components used.....	22
5	Circuit connections of the components.....	23
6	Original sample images of normal, moldy, slaty, and damage.....	25
7	Artificial neural network architecture.....	27
8	Flowchart for system program.....	29
9	Block diagram of the system.....	32
10	Exterior and interior view of the chamber unit.....	33
11	The 3-10-1 trained ANN model.....	35
12	Accuracy and loss of the ANN model.....	36
13	Graph of the accuracy and loss during training and validation.....	36
14	The GUI of the system	37
15	Classifying section of the GUI.....	38
16	Classified beans shown in the GUI.....	38
17	Data gathering section of the GUI.....	39
18	Introduction section of the GUI.....	40

LIST OF APPENDICES

Appendix		Page
1	Program Codes.....	53
2	Documentation.....	65
3	Computations.....	72
4	Forms.....	83

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INTRODUCTION

Cacao (*Theobroma cacao* L.) tree is a lean and perennial evergreen that can grow 4 to 8 m tall in cultivation and up to 20 m in natural conditions. It bears fruits called cacao pods that are ovate with a color that varies from vividly yellow to heavy purple. The matured pod can reach a maximum height of 35 cm (14 inches) and 12 cm (4.7 inches) in width. The produced pod can contain 20 to 60 cacao beans or cacao seeds, each enclosed in a white sticky pulp (Cook, 2018). Cacao beans are the key ingredient in making chocolate confectionery. Aside from being processed as edible substances, it can also yield products like pharmaceutical and cosmetic goods (Ecosystems Research and Development Bureau, 2015).

Since the 1970s, many cacao by-products have appeared in the global market. This resulted in a significant increase in the demand for cacao production, which tripled in numbers from 1970. The cacao industry in both national and international markets is unceasingly getting big as the world continuously consumes products that use cacao as raw materials.