DEVELOPMENT OF A UNIFORM DETECTION SOFTWARE USING YOLOV8 ALGORITHM FOR THE UNIVERSITY OF SOUTHERN MINDANAO STUDENTS

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ACCEPTANCE OF THESIS

The thesis attached hereto, entitled "**DEVELOPMENT OF A UNIFORM DETECTION SOFTWARE USING YOLOV8 ALGORITHM FOR THE UNIVERSITY OF SOUTHERN MINDANAO STUDENTS**" prepared and submitted by **JOSHUA M. TEJEDOR** in partial fulfillment of the requirements for the degree of **BACHELOR OF SCIENCE IN ELECTRONICS ENGINEERING** is hereby accepted.

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BIOGRAPHICAL DATA

The researcher was born on August 15, 2000, in Puerto Princesa City, Palawan. He is the only son of Mr. Jonathan Nuenay Tejedor and Mrs. Mary Ann Martinez Tejedor.

The researcher grew up in the Municipality of Narra, Palawan, and attended his primary school at Narra Pilot School for three years and transferred to Lampayan Elementary School when he was in fourth grade and graduated in the year 2013. He then studied at Lampayan National High School and graduated in the year 2017. He pursues his senior high school as a student of General Academic Strand at the said school and graduated in the year 2019.

The researcher's passion for electronics and technology led him to pursue a degree in Bachelor of Science in Electronics Engineering at the University of Southern Mindanao at Kabacan, Cotabato.

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The following individuals helped the researcher complete his undergraduate thesis successfully, and he would like to convey his sincere gratitude to them:

The researcher would first like to express his gratitude to God for His unfailing love, grace, and gifts. His religious beliefs have provided him with support, solace, and direction throughout his academic and personal journey.

The researcher would like to thank his adviser, Engr. Jerry T. Piamonte, for his unwavering guidance, expertise, and patience throughout the research process. His invaluable insights and constructive feedback have shaped the researcher’s academic and professional growth.

The researcher would also like to extend his heartfelt appreciation to the members of the panel and Department Research Coordinator who evaluated his thesis, Engr. Vina Rose Alquizar, Engr. Chenneemae Bandoy, Dr. Maricel Dayaday and Engr. Geraldo Ulep, for their time, effort, and insightful comments that helped improve the quality of his work.

The researcher would like to acknowledge the support and encouragement he received from his classmates, friends, and close friends, who stood by him and provided moral support throughout his engineering journey.

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Last but not least, the researcher would like to express his sincere gratitude to his loving, understanding and supportive parents, Jonathan N. Tejedor and Mary Ann M. Tejedor, for their sacrifices made from day one and throughout his academic career. Their guidance, encouragement, financial support, and sacrifices have molded his opinions, convictions, and personality.

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ABSTRACT

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This study aimed to create software that could detect whether students were wearing complete or incomplete uniforms. The method used an image classifier and object detection algorithms to analyze video footage captured by a camera. The software's accuracy was evaluated to measure its performance. The software was developed using the Python programming language and custom training of the YOLOv8 object detection algorithm. The input was video footage from a university camera. The software output included a database of logs of images of students wearing complete and incomplete uniforms, along with the software application. Descriptive research design and statistics were used to evaluate the software's functionality. The study resulted in creating a fully operational Uniform Detection Software. The system was effective in detecting students who were wearing complete uniforms and those who were not and can promote a more organized and disciplined campus environment.

Keywords: complete uniform, image classifier, object detection, software development, university dress code, YOLOv8.

INTRODUCTION

Among educational institutions, the utilization of school uniforms is a popular method aimed at instilling discipline and orderliness on campuses. By providing an easily recognizable visual cue for students, wearing a school uniform also facilitates enhanced safety measures by enabling quick identification of members within the premises. Moreover, uniforms aid in recognizing students during excursions and in crowded settings. (Hughes, n.d.). Currently, the University of Southern Mindanao relies on manual inspection to enforce its dress code policy, which has proven to be time-consuming and ineffective. This study proposes the development of a Complete Uniform Detection Software, which aims to streamline the process of identifying students who are not in compliance with the dress code. The software will be a valuable tool in enforcing the university's dress code policy. The findings of this study will be beneficial to educational institutions in promoting a more organized and disciplined campus environment through the use of technology. At USM, students are expected to follow a dress code that requires them to wear uniform clothing. A mark of absence or denial of admission could occur if this is not done. In any case, the college recognizes PE garbs as an exemption for this standard during PE classes.

Creating a software using the YOLOv8 algorithm with the goal of monitoring student compliance with uniform policy is what this research endeavors to accomplish at the University of Southern Mindanao. More specifically, it aims to address these specific targets: (a) develop a program that can detect if students are wearing entirety their university-mandated attire; (b) implement an image classifier and object detection to the video captured to check if the students are wearing a university-mandated attire, and (c) evaluate the performance of the software in terms of accuracy of detection.

The implementation of the study was conducted at the University of Southern Mindanao, Kabacan, North Cotabato, during the second semester of Academic Year 2022-2023. The study's scope was limited to software development and evaluation of the accuracy of detection only.

Conceptual Framework

The figure below shows the conceptual framework of the study, which includes the problem, solution, and results.

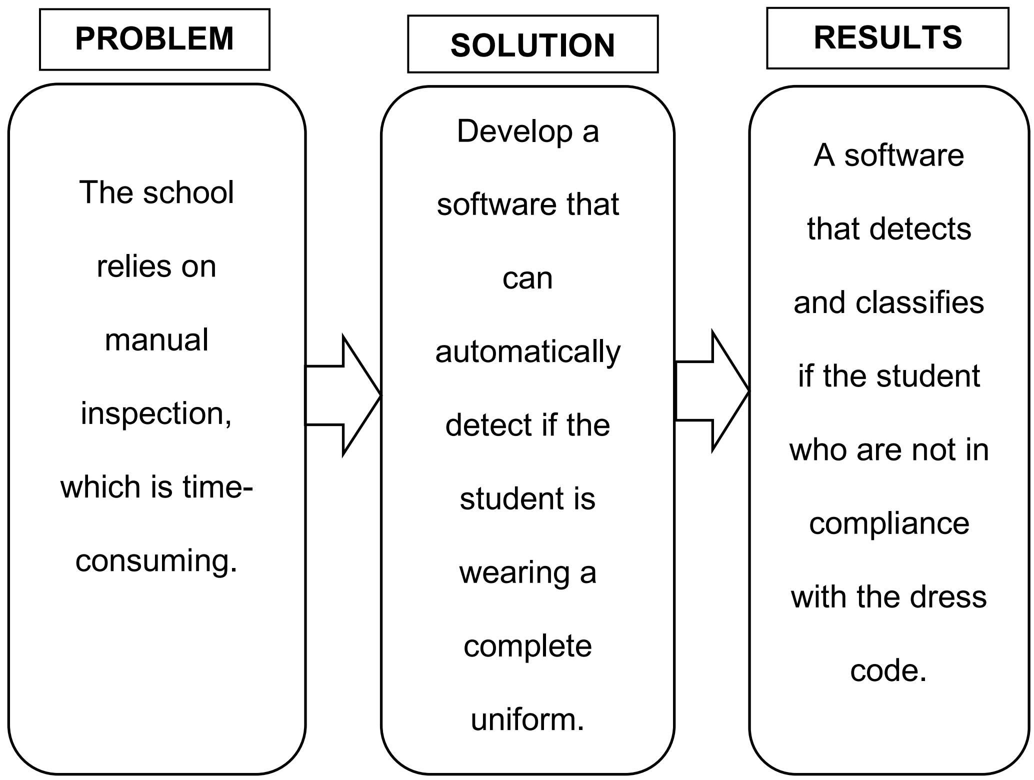


Figure 1. Conceptual framework

Operational Definition of Terms

The terms that are used in the study are theoretically and conceptually defined as follows:

Python – is a high-level programming language that has numerous characteristics, including an easy-to-understand syntax, support for object-oriented programming, and extensive library support.

School uniform – an ensemble, a set of uniforms used mainly for an educational institution. The term "school uniform" refers to a predetermined ensemble of garb that is compulsory for pupils to wear while attending school. Shirt, skirt, blouse, pants, or trousers, as well as shoes, may all be part of the uniform. In most cases, the school administration chooses both the color and the design of the student uniform.

Convolutional Neural Network – is a deep learning subset. It is one of many artificial neural networks utilized for diverse purposes and data kinds. A CNN is a type of network design for algorithms using deep learning primarily utilized for image recognition and pixel computational applications.

Makesense.ai – is a free web application that assists you in labeling photographs, making the preparation of a dataset for a computer vision deep learning project simpler and quicker. You may save the labels you generate in a variety of formats.

YOLO – “You Only Look Once”. An algorithm that searches for and identifies various items included inside an image (in real-time). Object identification in YOLO is carried out in the form of a regression problem, and the program then returns the class probabilities of the found photographs. The YOLO approach makes use of in real-time object identification by leveraging (CNN).

OpenCV – The framework is open-source and available for no cost. Image processing applications were supposed to be standardized, and the speed of machine perception in commercial goods was supposed to be increased. The Apache 2 license applies to OpenCV.

React JS – which is also called React, is a JavaScript library that is free and open-source. Its main purpose is to create user interfaces by piecing together different code sections or components to form complete websites.

Google Colaboratory – which is often abbreviated as "Google Colab", is a tool for analyzing data and implementing machine learning algorithms.

REVIEW OF RELATED LITERATURE

The researcher has found some articles on the internet that relate to the proposed study.

CNN Classification on Clothing

According to studies, employing a Convolutional Neural Network (CNN) to do picture categorization on apparel is an effective method. A CNN can learn to detect patterns and extract useful characteristics from images automatically. This is especially useful for recognizing objects in images, as the CNN can learn to identify the shape, color, and texture of an object. A CNN is also efficient at classifying images because it can be trained on a large dataset and can then be used to classify new images very quickly. This is due to the fact that a CNN can be “transfer learning”, which means that it can learn from a pre-trained model. It is also efficient at classifying images, as it has a lower number of parameters (Elleuch et al., 2021).

The title of another study is Classification of Garments from Fashion MNIST Dataset Using CNN LeNet-5 Architecture. In this study, CNNs have been found to be very effective in image classification tasks. This is because CNNs are able to learn the complex spatial relationships between different objects in an image. Additionally, CNNs are able to learn hierarchical representations of images, which is essential for image classification. The results of this study show that the LeNet-5 model is very effective at classifying images of garments from the Fashion MNIST dataset. The model outperformed both the traditional CNN model and the other current state-of-the-art models in the literature, with an accuracy of 98.9%. Furthermore, the model achieved great recall and accuracy for each category (Kayed et al., 2020).

The suggested CNN model classification is thus suitable for the installation of garment classifiers on cameras in order to conserve energy and get thermal comfort, according to another study. The You Only Look Once version 3 and Tiny You Only Look Once (YOLO) were then used to construct a new dataset with 12,000 photos for real-time analysis. Finally, any additional webcam may be used for real-time analysis. The model detects at least three clothes from a clothing ensemble, demonstrating that it can identify more than one garment. Furthermore, the model exhibits at least 90% accuracy in the test dataset, indicating that it is generalizable and not overfitting (Medina et al., 2022).

YOLOv8 Algorithm

With its innovative object detection and image segmentation capabilities, Ultralytics YOLOv8 stands out as a leading model in the field of vision AI. This sophisticated system features a new backbone network, anchor-free split head, and advanced loss functions. These enhancements enable it to deliver unparalleled performance, accuracy, and flexibility while maintaining remarkable speed and size. When it comes to performing computer vision operations like detection, segmentation, tracking or even classification, YOLOv8 stands out as a popular choice due to its versatility. This deep learning model is designed for performance and accuracy without compromising on the flexibility required by various applications.

In fact, according to Ultralytics' documentation, it's one of the best frameworks out there offering both speed and capability through integration with new innovations in computer vision technology. The wide applicability of YOLOv8 makes studying it worthwhile for those experienced in machine learning and those who are new.

It is safe to conclude that the Ultralytics YOLOv8 stands out due to its advanced capabilities in terms of performance, flexibility, and efficiency as compared to its earlier versions. The model is suitable for various vision AI tasks due to its compatibility with different hardware platforms. Practitioners new and experienced both can benefit from the user-friendly (Ultralytics, n.d.).

YOLO in Object Detection

According to the study, You Only Look Once (YOLO) is a unified object identification model that is easy to build and can be trained on entire photos. It is also the most efficient general-purpose object detector. YOLOv2 offers the best balance between real-time speed and good accuracy for object recognition when compared to other detection algorithms over a wide range of detection datasets. Furthermore, since You Only Look Once (YOLO) generalizes objects better than other models, it is suited for applications that depend on quick, robust object recognition. These outstanding and valuable benefits make it deserving of being aggressively suggested and promoted. (Du, 2018).

According to another study from Diwan, the YOLO object detection algorithm is a single-stage algorithm that is faster and more accurate than its two-stage counterparts such as the RCNN and the Fast-RCNN. The You Only Look Once (YOLO) algorithm has been optimized in successive versions and is currently state-of-the-art in object detection. The You Only Look Once (YOLO) algorithm achieves its speed and accuracy by using a pretrained CNN to generate feature maps, which are then fed into a fully connected layer to produce bounding boxes and class probabilities. The You Only Look Once (YOLO) algorithm also capable of handling class imbalance and multi-label data (Diwan, 2022).

According to Yin et al. study, object detection is the process of identifying and recognizing things in digital photos or videos. It is a complicated process since it requires identifying and finding something within the same picture. Deep convolutional neural networks (DCNNs) have recently been proven to perform very well in object identification. However, supervised training of DCNNs is time-consuming and fraught with issues such as local minima, significant human involvement, and so on. In this study, we offer a novel approach dubbed Faster-You Only Look Once (YOLO) that can identify objects in real-time. It accepts raw photos as input and is appropriate for various datasets. Furthermore, since most connection weights are produced randomly, there are fewer parameter settings, and the training pace is quicker. (Yin et al., 2020).

According to the research of Zhao and Wang, the You Only Look Once (YOLO) algorithm is a deep learning algorithm that is designed to detect objects in real time. The approach is built on the concept of a single neural network capable of detecting objects in images. The algorithm has been shown to be effective at detecting objects in images. The You Only Look Once (YOLO) algorithm has been tested on a dataset of cutters and a dataset of crowds. The results of the tests showed that the You Only Look Once (YOLO) algorithm was able to detect the cutters with a high level of accuracy and that the algorithm was able to detect the crowds with a high level of accuracy (Zhao & Wang, 2022).

A substantially large epoch size doesn't invariably lead to enhanced accuracy. Once a single epoch is completed in a neural network, every bit of training data has contributed to fine-tuning the model's parameters. While epoch sizes can amplify precision to a certain extent, surpassing that limit causes the model to overfit the data. Conversely, an exceedingly low size may yield inadequate fitting. The stark contrast between epoch 99 and epoch 100 indicates overfitting already taking place. Generally speaking, the ideal epoch range spans from 1 to 10, reached when accuracy in deep learning ceases to progress. Indeed, a count of 100 appears to be excessive (How Does Epoch Affect Accuracy? | Deepchecks, 2022).

In that study, the researcher concentrated on developing software that could identify whether a person was wearing a complete uniform using You Only Look Once (YOLO) and CNN. The researcher employed CNN to classify uniform clothing and You Only Look Once (YOLO) for object detection, similar to other studies. However, the distinguishing feature of the proponent's study was the utilization of the latest You Only Look Once (YOLO) architecture You Only Look Once version 8 (YOLOv8), which was more precise and had better performance in object detection.

METHODOLOGY

Materials & Applications

Laptop with the same capabilities often cost more than desktops because they are more complicated to develop and produce, they may be used to write code, troubleshoot programs, and evaluate programs.

Mobile camera is a substitute for a USB 2.0 webcam a piece of equipment used for photographing, filming, or creating television images.

Python is a high-level programming language that is object-oriented and interpreted. Its built-in high-level data structures, dynamic typing, and dynamic binding make it a good fit for RAD. Its versatility as a scripting or glue language makes it a great option. Python's easy-to-learn syntax emphasizes readability, reducing program maintenance costs. Python's modules and packages facilitate modularization and reusability.

YOLOv8 the astonishing characteristic of YOLOv8 is rewriting the book on computer vision. The genuine YOLOv8 is both quick and precise in its operations. The Yolov8 weights are learned with the help of the COCO dataset developed by Microsoft. CNN will be used in this research to recognize and categorize various items.

React JS is a free and open-source JavaScript library used for building user interfaces (UIs) in web and mobile applications. It was created by Facebook and is maintained by a community of developers. It enables the creation of reusable UI components and efficiently updates and renders changes based on the application's data. Developers describe the UI's desired state and React handles the underlying JavaScript code to achieve it.

OpenCV (Open-Source Computer Vision Library) OpenCV is free computer vision and machine learning software. OpenCV built a common architecture for computer vision applications to facilitate AI integration.

Camo Studio is a software application that enables users to utilize their iOS and Android as high-quality webcams on their computers. It offers advanced features like camera control, background blur, and virtual green screen effects and is compatible with several video conferencing and streaming applications. It's available for Mac and Windows.

Google Colaboratory is a free cloud-based platform that allows users to run Python code, collaborate on machine learning projects, and access a virtual machine with pre-installed software and hardware resources, including GPUs. It has an easy-to-use interface and is accessible via any web browser, making it a versatile tool for data analysis and scientific research.

Methods

This section detailed the methods used in the conduct of the study.

Complete Uniform Detection Software Analysis

Figure 2 illustrates the block diagram of the study. It has three elements. The input, process, and output.

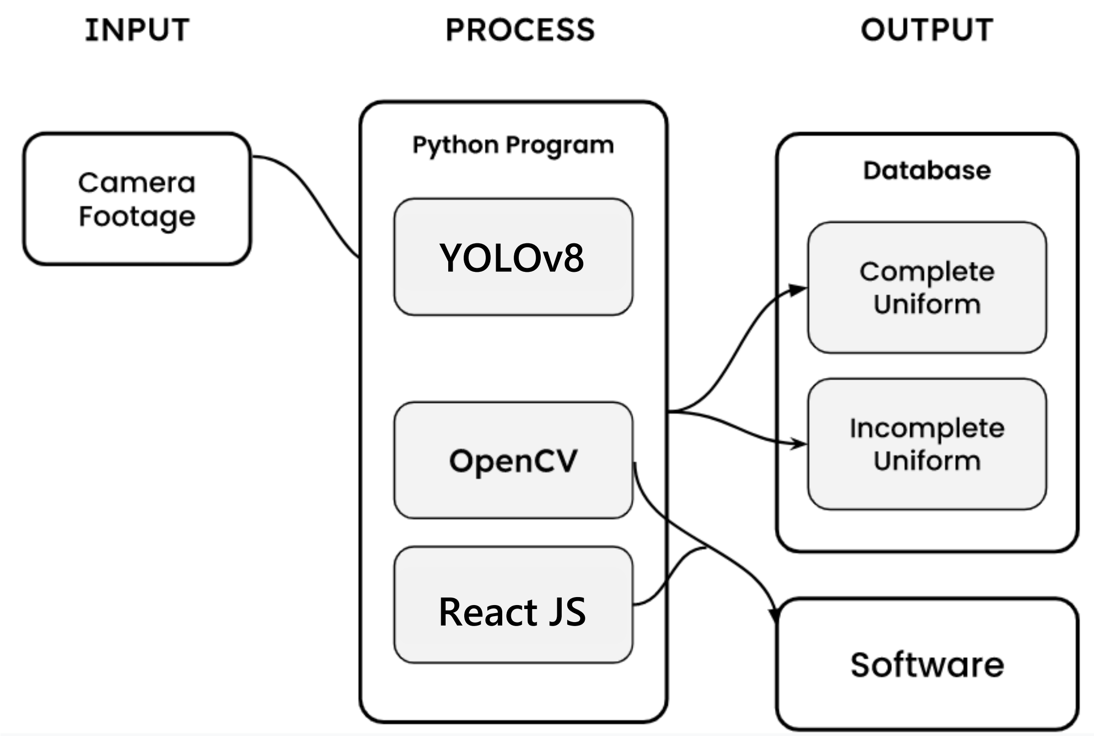


Figure 2. Block diagram of Complete Uniform Detection Software

Input

Video footage captured by a camera situated at the University of Southern Mindanao, Kabacan, North Cotabato is the input for this study, as it captures the student for analysis.

Process

An image classifier and object detection algorithms are used in the process of analyzing the captured video footage. The input is then fed into a custom trained YOLOv8 object detection algorithm, which has been specifically trained on the Google Colaboratory platform. The YOLOv8 algorithm is employed to classify whether a student is wearing a complete uniform or not. Software development is accomplished through the use of the Python programming language, while the graphical user interface (GUI) is created using React JS. The footage is rendered using OpenCV, while the Camo Studio software acts as a substitute for a USB 2.0 webcam.

Output

A database and software application are the outputs of this study. The database contains logs of images of students wearing complete uniforms and those who are not. The software application, designed with user-friendliness in mind. It has been found to be effective in detecting students who are not in compliance with the dress code, resulting in the creation of logs of images of such students.

Development of the Program

This study used VS Code IDE (Integrated Development Environment) and Google Colaboratory using Python 3 programming language in developing the software.

Creation of the Dataset for Training

To train YOLOv8 to only detect what was needed for the study, a custom dataset was required. "makesense.ai" was used to create a custom dataset that YOLOv8 could read. Figure 3 showed an example of annotating datasets for object detection.

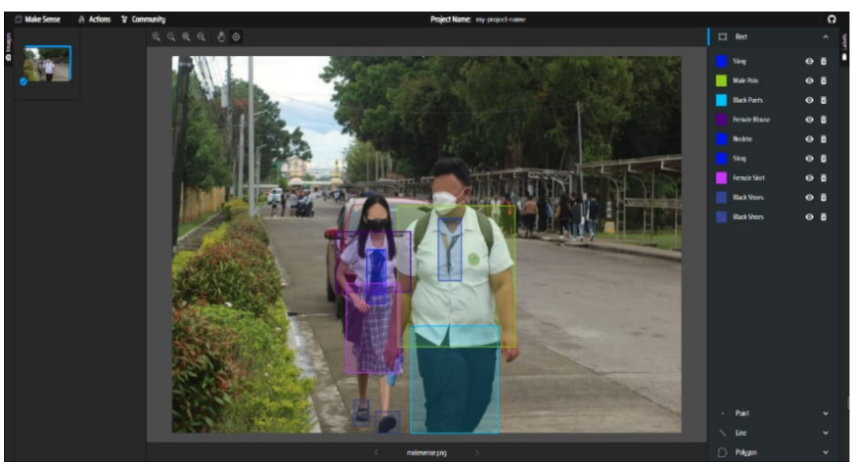


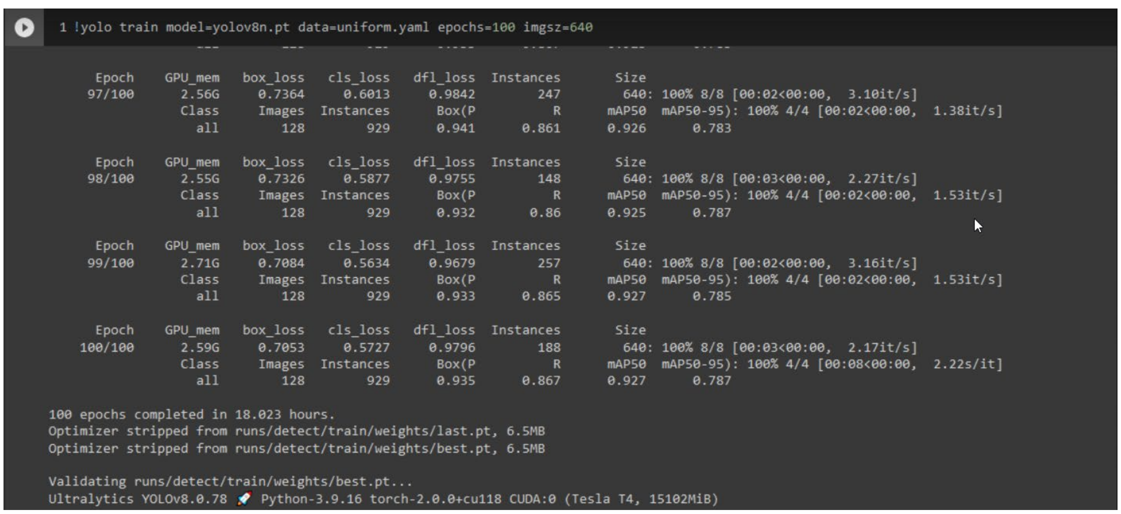
Figure 3. Data annotation using makesense.ai

Dataset Partitioning

It was therefore necessary to divide the dataset into training, validation, and test sets. The researcher had a total of 650 images, out of which 520 were allocated for training, 65 for validation, and 65 for the test set. Each of these sets corresponded to 80%, 10%, and 10% of the data, respectively. All of this was done automatically inside Python.

Training YOLOv8 using the Custom Dataset

The training used a batch size of 16, an image size of 640, and was trained for 100 epochs.



```
1 !yolo train model=yolov8n.pt data=uniform.yaml epochs=100 imgsz=640

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     97/100      2.56G     0.7364     0.6013     0.9842        247        640: 100% 8/8 [00:02<00:00,  3.10it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 4/4 [00:02<00:00,  1.38it/s]
                   all        128        929      0.941      0.861      0.926      0.783

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     98/100      2.55G     0.7326     0.5877     0.9755        148        640: 100% 8/8 [00:03<00:00,  2.27it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 4/4 [00:02<00:00,  1.53it/s]
                   all        128        929      0.932       0.86      0.925      0.787

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
     99/100      2.71G     0.7084     0.5634     0.9679        257        640: 100% 8/8 [00:02<00:00,  3.16it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 4/4 [00:02<00:00,  1.53it/s]
                   all        128        929      0.933      0.865      0.927      0.785

      Epoch    GPU_mem   box_loss   cls_loss   dfl_loss  Instances       Size
    100/100      2.59G     0.7053     0.5727     0.9796        188        640: 100% 8/8 [00:03<00:00,  2.17it/s]
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 4/4 [00:08<00:00,  2.22s/it]
                   all        128        929      0.935      0.867      0.927      0.787

100 epochs completed in 18.023 hours.
Optimizer stripped from runs/detect/train/weights/last.pt, 6.5MB
Optimizer stripped from runs/detect/train/weights/best.pt, 6.5MB

Validating runs/detect/train/weights/best.pt...
Ultralytics YOLOv8.0.78 🚀 Python-3.9.16 torch-2.0.0+cu118 CUDA:0 (Tesla T4, 15102MiB)
```

Figure 4. Training YOLOv8 using Custom Datasets

User Interface Design

React JS was used to design the user interface of the software. It also used OpenCV for rendering the camera footage and showing the bounding boxes of detected entities. The user interface design was kept simple and only showed the necessary information.

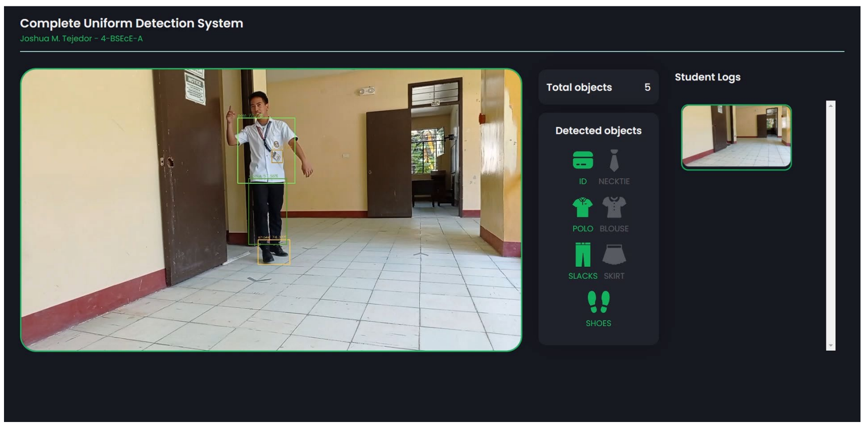


Figure 5. User Interface of the Software

Research Design

The study was conducted using a descriptive research design to describe the functionality of the study.

Data Gathering Procedure

In gathering the data, the researcher collected the test results from the Complete Uniform Detection Software. The process determined the complete uniform in which the proponent conducted their study. The functionality of the system was observed based on its ability to detect if the student is wearing a complete uniform. These were the factors considered by the proponent in determining how functional the system was in detecting students wearing a complete uniform. The frequency table was made for the summation of the gathered data. The program's functionality was tested via videos. The results of the video were evaluated. Table 1 represented the data gathered for testing the system found on page 22.

$$\text{Software Accuracy (\%)} = \frac{\text{sum of all samples correctly identified}}{\text{total number of all samples}} \times 100$$

Statistical Analysis

To prove that the study worked properly, the collected data was analyzed using the mean as the descriptive statistical method to interpret the results.

RESULTS AND DISCUSSION

In this chapter, the gathered data during the evaluation of the software is discussed and analyzed.

Software Performance

The study aimed to develop a software that could detect whether students were wearing complete uniforms or not. The accuracy of detection was evaluated to measure the software's performance. Out of the 20 students tested, the software correctly identified 17 students, while 3 students are also correctly identified, but the software detects some garments even though the students were not actually wearing them, as a result researcher considered it as not identified correctly because of wrong detection of garments. The software could detect only one student at a time. If the software detects a student, it will be logged with details such as the time of detection, the gender of the detected student, and whether the student is wearing a complete uniform or not. If the student is identified as incomplete uniform, the software will log the missing item. The figure 5 below shows the appearance of the student log along with its details.

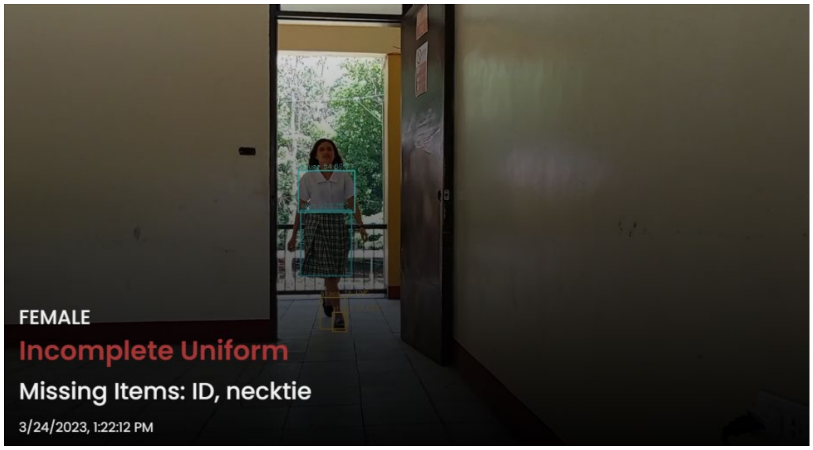


Figure 6. Incomplete uniform student log along with details

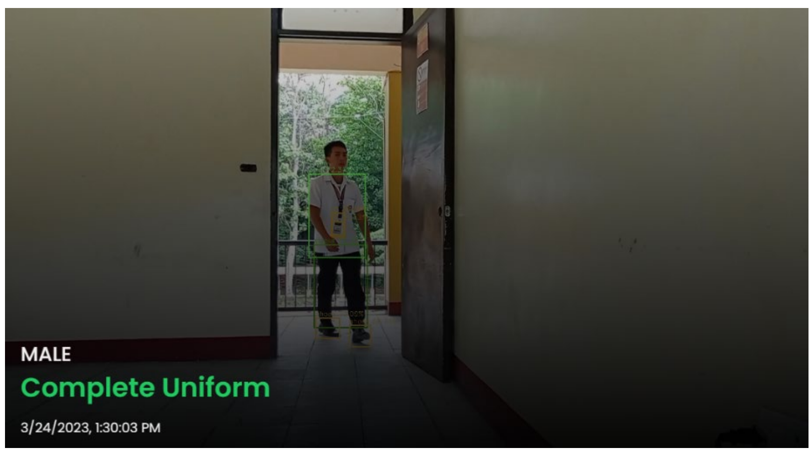


Figure 7. Complete uniform student log along with details

Accuracy of Detection

The accuracy of detection is an essential aspect of the software's performance. The accuracy of the Complete Uniform Detection Software was evaluated by testing the software on a group of 20 students. The results showed that the software had an accuracy rate of 85%. The software could detect students who were not wearing a complete uniform and could log the missing item. However, the software failed to detect three students who were not wearing complete uniforms.

The object detection algorithm used in this study was YOLOv8, which was trained using a custom dataset. Despite the software's good performance, the three misclassified students indicate that there is room for improvement.

$$\textbf{Software Accuracy (\%)} = \frac{17}{20} \times 100 = \textbf{85\%}$$

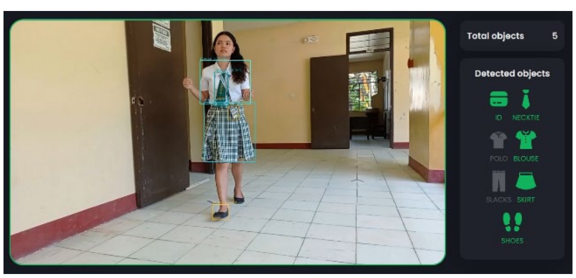
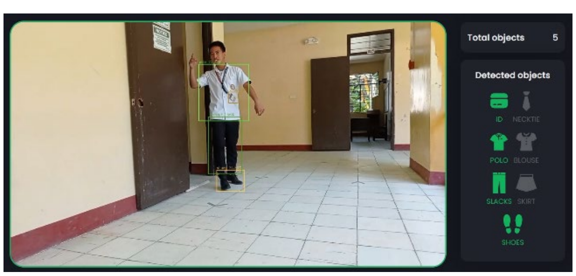
Table 1. Results of System Functionality of Detecting Software

SAMPLE IMAGES	CLASSIFICATION		CORRECTLY IDENTIFIED	
	COMPLETE	INCOMPLETE	YES	NO
Image 1	✓		✓	
Image 2	✓		✓	
Image 3	✓		✓	
Image 4		✓	✓	
Image 5		✓	✓	
Image 6		✓	✓	
Image 7		✓	✓	
Image 8		✓	✓	

Continuation

Image 9		✓	✓	
Image 10		✓	✓	
Image 11		✓	✓	
Image 12		✓	✓	
Image 13		✓		✓
Image 14		✓	✓	
Image 15		✓	✓	
Image 16		✓	✓	
Image 17		✓		✓
Image 18	✓		✓	
Image 19	✓		✓	
Image 20		✓		✓
SOFTWARE ACCURACY: 85.00%				

Table 2. Result images for system functionality of Detecting Software

IMAGES	**CLASSIFICATION**		**CORRECTLY IDENTIFIED**	
	COMPLETE	**INCOMPLETE**	**YES**	**NO**
	COMPLETE		YES	
	COMPLETE		YES	

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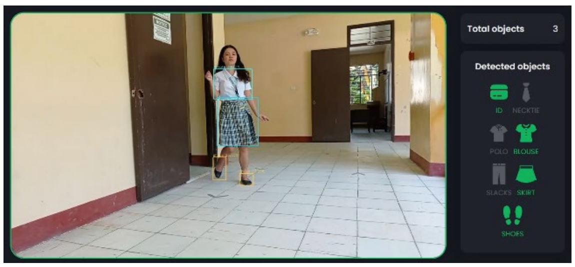
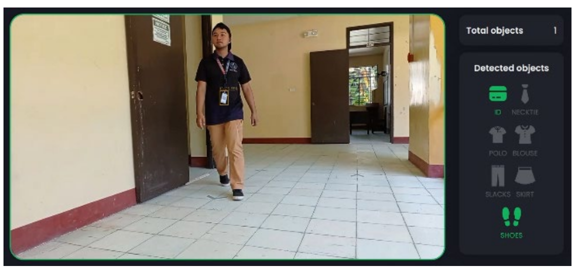
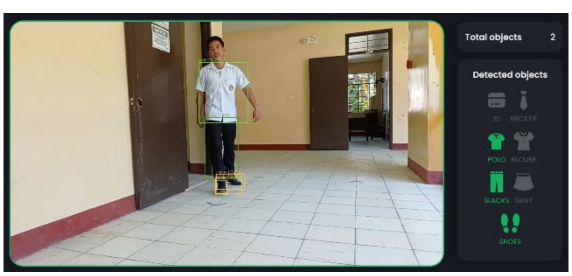
	COMPLETE	YES
	INCOMPLETE	YES
	INCOMPLETE	YES
	INCOMPLETE	YES
	INCOMPLETE	YES

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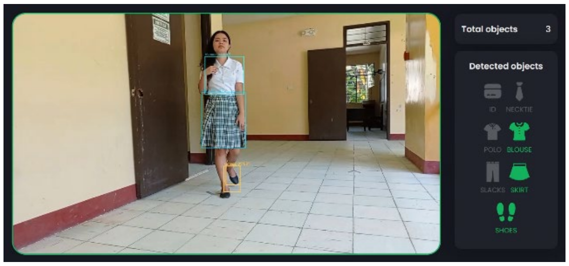
INCOMPLETE YES



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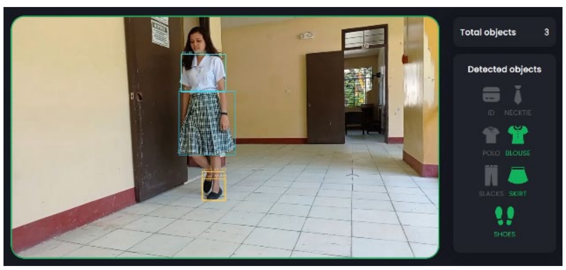

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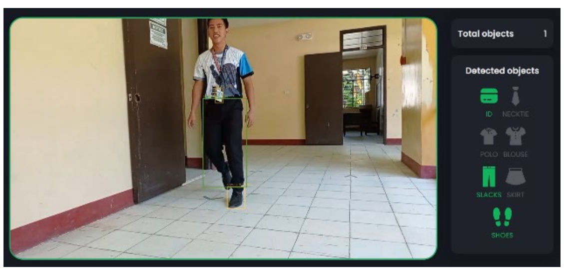

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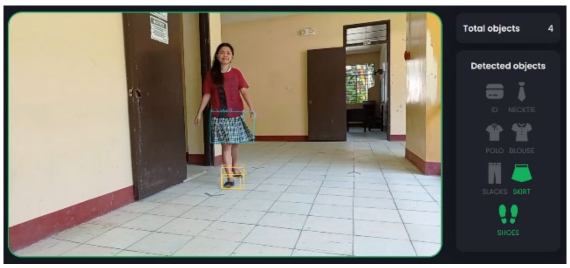
<tr><td>
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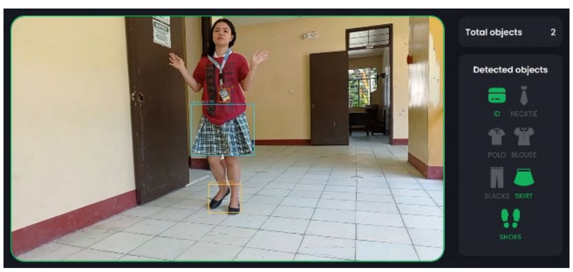
<tr><td>
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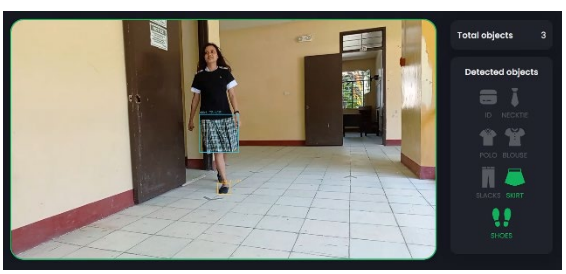
<tr><td>
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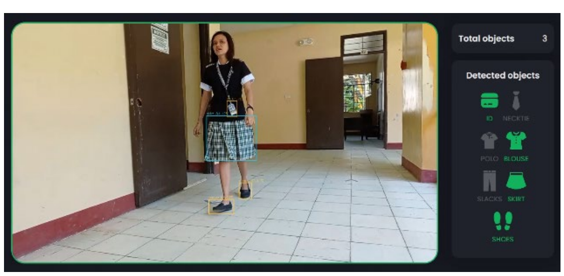
<tr><td>
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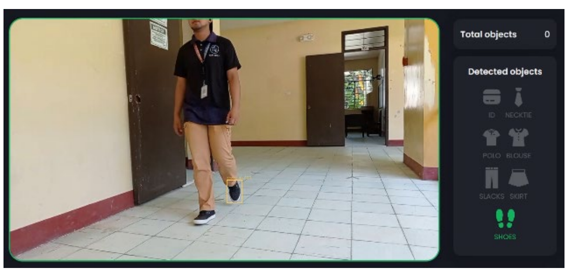

INCOMPLETE NO

SOFTWARE ACCURACY: 85.00%

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This study focused on the development of a Complete Uniform Detection Software for the University of Southern Mindanao students, aimed at identifying whether students were wearing complete or incomplete uniforms. The software was developed using the Python programming language and custom training of the YOLOv8 object detection algorithm. Descriptive research design and statistics were employed to evaluate the software's functionality. The software effectively detected students wearing complete uniforms, and those who were not, with an accuracy rate of 85%. The system also maintained a database of logs containing images of students wearing complete and incomplete uniforms, along with the software application.

The study concluded that the objectives of the study were achieved as the researchers were able to develop a software that can detect if students are wearing a complete uniform, applied an image classifier and object detection to the video captured by the camera, and evaluated the performance of the software in terms of accuracy of detection. The software's ability to accurately detect students wearing complete uniforms and those who were not, in addition to its user-friendly interface and efficient logging system, make it a practical solution for enforcing dress code policies in academic institutions. However, the study revealed that there is room for improvement, as three students were misclassified during the testing phase.

Based on the findings, it is recommended that future research should focus on improving the accuracy of the software by refining the object detection algorithm and the custom training dataset. Additionally, incorporating additional features, such as custom datasets of students wearing Physical Education (PE) and University Laboratory School (ULS) uniforms, would be useful. Finally, it would be beneficial to enhance the software's ability to detect students' uniforms simultaneously and to use a powerful laptop to avoid lag in the video captured by the camera. Also add database that can store in cloud to avoid occupying your storage and produce data on the number of male and female who pass through the camera.

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APPENDICES

Appendix A. Application for Change Research Title

UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Cotabato
Philippines

APPLICATION FOR CHANGE RESEARCH TITLE

Date: 2023.04.17

GERALDO P. ULEP
Chairperson, Department of Electronics Engineering

Madam:

I would like to request your office to allow me to research the study entitled "**Development of a Uniform Detection Software Using YOLOv8 Algorithm for the University of Southern Mindanao Students**."

The study has the following objectives:

1. To develop software that can detect if the student of the university is wearing a complete uniform.
2. To apply an image classifier and object detection to the video captured by the camera to check if the students are wearing a complete uniform.
3. To evaluate the performance of the software in terms of accuracy of detection.

Very truly yours,

JOSHUA M. TEJEDOR
Printed Name and Signature of Student

NOTED	
JERRY T. PIAMONTE, PECE Adviser	2023.04.17 Date
GERALDO P. ULEP, PECE Department Research Coordinator	2023.04.20 Date
FLOREEY MAE F. PASCUA College Research Coordinator	2023.04.25 Date
APPROVED	
GERALDO P. ULEP, PECE Department Chairperson	2023.04.26 Date

Appendix B. Actual Budget of the Research

UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Cotabato
Philippines

ACTUAL BUDGET OF THE RESEARCH

Title of Study: Development of a Uniform Detection Software Using YOLOv8 Algorithm for the University of Southern Mindanao Students

ITEMS/DESCRIPTION	COST
1. Sundry (binding and reproduction)	
a. Outline	**1000.00**
b. Manuscript	**1700.00**
2. Internet fees	**1200.00**
3. GTX 1650	**3000.0**
4. Webcam	**1000.00**
5. Travel	**500.00**
6. Google Colab	**1000.00**
Grand Total	**9400.00**

Prepared and submitted by:

JOSHUA M. TEJEDOR
Printed Name and Signature of the Student

NOTED	
JERRY T. PIAMONTE, PECE Adviser	2023. 04. 20 Date
GERALDO P. ULEP, PECE Department Research Coordinator	2023. 04 .24 Date
GERALDO P. ULEP, PECE Department Chairperson	2023. 04 .24 Date

Appendix C. Application for Manuscript Defense

UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Cotabato
Philippines

APPLICATION FOR MANUSCRIPT DEFENSE

Name	JOSHUA M. TEJEDOR
Degree	BACHELOR OF SCIENCE IN ELECTRONICS ENGINEERING
Thesis Title	DEVELOPMENT OF A UNIFORM DETECTION SOFTWARE USING YOLOV8 ALGORITHM FOR THE UNIVERSITY OF SOUTHERN MINDANAO STUDENTS
Date of Examination	APRIL 17, 2023
Time	11:30 AM – 1:00 PM
Place	COLLEGE OF ENGINEERING AND INFORMATION TECHNOLOGY

MEMBERS OF THE EXAMINING COMMITTEE

Name	Signature	Date
DR. MARICEL G. DAYADAY		2023.04.14
ENGR. VINA ROSE O. ALQUIZAR		2023.04.14
ENGR. CHENNEEMAE B. BANDOY		2023.04.14

RECOMMENDING APPROVAL:

JERRY T. PLAMONTE
Adviser

Co-Adviser (Optional)

APPROVED:

College Statistician (Optional)

GERALDO P. ULEP, PECE
Department Research Coordinator

GERALDO P. ULEP, PECE
Department Chairperson

REPORT ON THE RESULT OF EXAMINATION

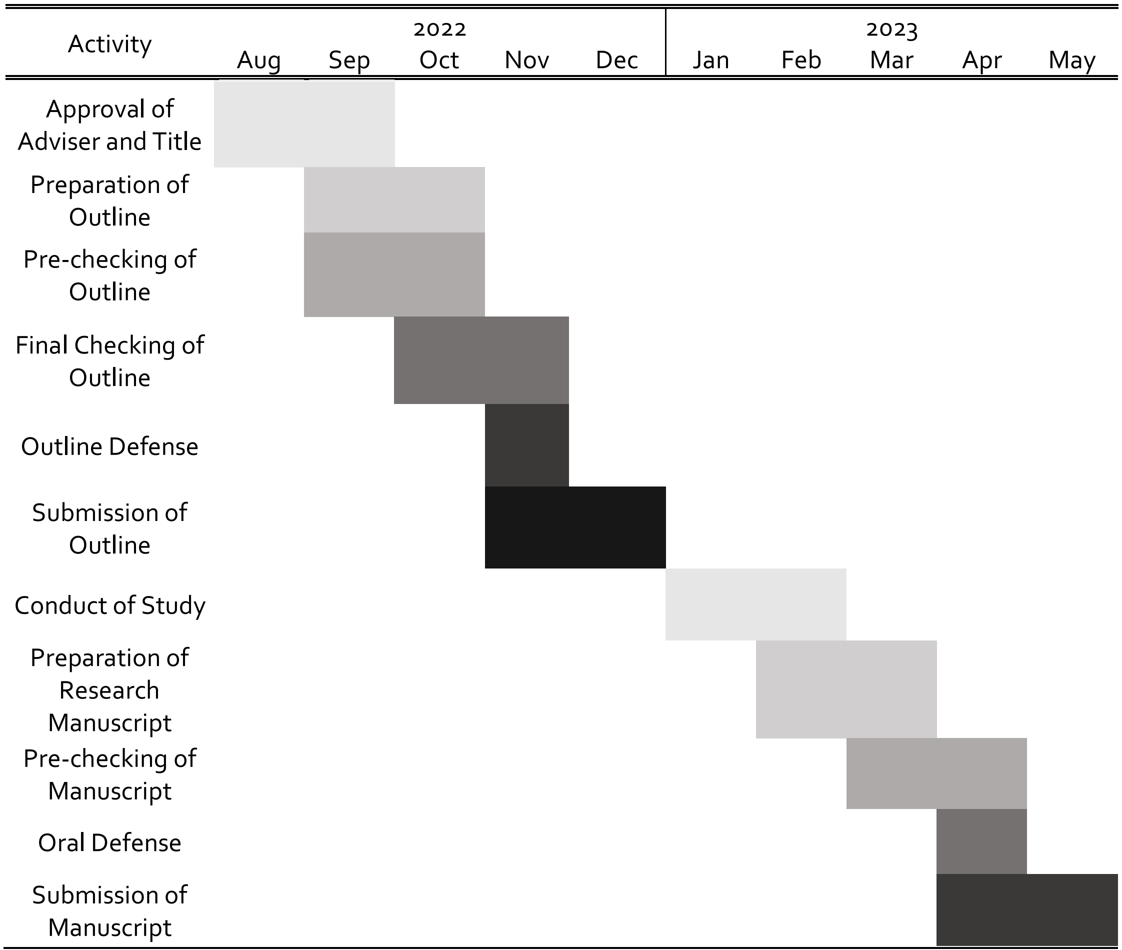
Name	Signature	Remarks
DR. MARICEL G. DAYADAY		PASSED
ENGR. VINA ROSE O. ALQUIZAR		PASSED
ENGR. CHENNEEMAE B. BANDOY		PASSED

APPROVED:

GERALDO P. ULEP, PECE
Department Research Coordinator

2023.04.17
Date

Appendix D. Gantt Chart



UNIVERSITY OF SOUTHERN MINDANAO
Kabacan, Cotabato
Philippines

CURRICULUM VITAE

Joshua M. Tejedor
Purok 5, Lampayan, Matalam, North Cotabato
09661953820
joshuatejedor11@gmail.com

PERSONAL INFORMATION	
Last Name	TEJEDOR
First Name	JOSHUA
Middle Name	MARTINEZ
Nickname	JOSH
Age	22
Nationality	FILIPINO
Religion	SFADB
Civil Status	SINGLE
Father's Name	JONATHAN N. TEJEDOR
Mother's Name	MARY ANN M. TEJEDOR
EDUCATIONAL BACKGROUND	
Elementary	LAMPAYAN ELEMENTARY SCHOOL LAMPAYAN, MATALAM, COTABATO 2007-2013
Junior High School	LAMPAYAN NATIONAL HIGH SCHOOL MATALAM, COTABATO 2013-2017
Senior High School	LAMPAYAN NATIONAL HIGH SCHOOL MATALAM, COTABATO 2017-2019
Tertiary	UNIVERSITY OF SOUTHERN MINDANAO KABACAN, COTABATO 2019-2023