International Journal of Scientific Research and Engineering Development-– Volume 9 Issue 2, Mar-Apr 2026
Available at www.ijsred.com

RESEARCH ARTICLE OPEN ACCESS

Leveraging Computer Vision for Institutional Governance: An Automated Real-Time School Uniform Detection System for Enhanced Discipline and Campus Security

Mary Joy R. Kquilala[1], Cristine Mea C. Caraos[2], Rodulfo Y. Kaquilala Jr[3], Jimar D. Villacarlos[4], Nova Mae B. Resuena[5], Rj B. Ilosorio[6], Dino L. Ilustrisimo[7], Kurt S. Bryan Alegre[8]

[1]*Bachelor of Science in Information Technology, Madridejos Community College, Bunakan, Madridejos, Cebu, Philippines*
Email: maryjoykaquilala15@gmail.com
[2]*Bachelor of Science in Information Technology, Madridejos Community College, Bunakan, Madridejos, Cebu, Philippines*
Email: caquilalacristinemea@gmail.com
[3]*Bachelor of Science in Information Technology, Madridejos Community College, Bunakan, Madridejos, Cebu, Philippines*
Email: kaquilalarodulfo179@gmail.com
[4]*Bachelor of Science in Information Technology, Madridejos Community College, Bunakan, Madridejos, Cebu, Philippines*
Email: jimarvillacarlos@gmail.com
[5]*Bachelor of Science in Information Technology, Madridejos Community College, Bunakan, Madridejos, Cebu, Philippines*
Email: novamae.resuena@mcclawis.edu.ph
[6]*Bachelor of Science in Information Technology, Madridejos Community College, Bunakan, Madridejos, Cebu, Philippines*
Email: rj.ilosorio@mcclawis.edu.ph
[7]*Dean, School of Information Technology, Madridejos Community College, Bunakan, Madridejos, Cebu, Philippines*
Email: dino.ilustrisimo@mcclawis.edu.ph
[8]*Insturctor, School of Information Technology, Madridejos Community College, Bunakan, Madridejos, Cebu, Philippines*
Email: kurtbryan.alegre@mcclawis.edu.ph

----------**********----------

Abstract:
Manual monitoring of school uniform compliance is a labor-intensive process prone to human error, inconsistencies, and security gaps, often allowing unauthorized individuals to enter premises undetected. This study presents the development and evaluation of an automated school uniform detection system designed to enhance institutional discipline and security. Employing a Developmental Research design with the Agile Development Model as the Software Development Life Cycle (SDLC) model, the system integrates advanced computer vision via the YOLOv5 (You Only Look Once) algorithm and Python-based real-time processing to identify attire compliance as individuals enter the campus. The hardware architecture leverages an ESP32-CAM to capture visual data, which is then analyzed for color accuracy and completeness of the uniform. System performance was evaluated by IT experts and engineers using ISO/IEC 25010 standards and the USE (Usefulness, Satisfaction, and Ease of Use) questionnaire. Results demonstrated high efficacy, with a mean score of 4.92 for displaying information and 4.94 for generating real-time records. The study concludes that automating uniform detection significantly streamlines administrative workflows, reduces staff burnout, and fosters a secure, disciplined academic environment.

Keywords — ***Agile Development Model, Automated Monitoring ,Campus Security Computer, Vision, School Uniform Detection, YOLOv5.***

----------**********----------

I. INTRODUCTION

In the field of computer vision, object detection is a captivating area of study, with one of its major tasks being the drawing of boundary boxes around detected objects [1]. Object detection is essentially the task of identifying specific objects of interest within an image or video. It recognizes the presence or absence of objects in certain scenes based on the camera's viewpoints [2]. Today, automated object detectors are used in various critical applications, including self-driving cars, medical research for disease identification, and security surveillance, enabling continuous monitoring and precise recognition in real-time scenarios [3]. Most of these processes are automated to minimize human intervention and reduce errors in our increasingly busy world [4].

In educational settings, however, uniform compliance is often still assessed manually by staff, leading to significant inefficiencies and inconsistencies in enforcement [5]. Manual monitoring has several negative impacts; it is primarily time-consuming, as instructors must physically check and record compliance, which detracts from essential instructional time [6]. Furthermore, manual monitoring can lead to inaccuracies, increased administrative workload, and potential personal biases [7]. Reliance on these manual tasks reduces the overall efficiency of staff and hinders their ability to focus on teaching, ultimately leading to staff burnout [8]. Research also indicates that constant monitoring practices can lead to adverse mental health outcomes and lower performance levels for instructors [9]. Automated uniform detection systems provide an effective solution to these challenges by ensuring consistent, objective, and efficient enforcement [10]. These systems promote a more professional environment and reduce the subjectivity often seen with manual checks, fostering a more equitable academic setting [11].

A. Objective of the Study

The study seeks to create and assess an automated school uniform detection system. Specifically:

1);Dashboard Development: To display daily records, total student entries, and specific counts for complete, incomplete, or non-compliant uniforms, alongside a video scanning view.

2);System Functionality: To develop a system that automatically verifies uniform completeness upon entry, identifies uniform color, and utilizes real-time processing to detect and display violations.

3);Data Recording: To accurately count and record the data of every student entering the school regarding their uniform status.

4);Impact Evaluation: To evaluate the system's effectiveness in improving student discipline, promoting policy adherence, and enhancing school security.

5);Usability Evaluation: To evaluate the usability, efficiency, and user satisfaction of the system using the USE (Usability, Satisfaction, Efficiency, and Effectiveness) questionnaire (Lund, 2001) [13].

6);System Quality Assessment: To determine the system's quality characteristics based on the ISO 25010[12] software and system quality model, focusing on performance, reliability, flexibility, safety, and maintainability to ensure optimal functionality and user trust.

II. METHODOLOGY

B. Research Design

This study employed a Developmental Research design, which focuses on the systematic design, development, and evaluation of technological solutions to address real-world problems (Richey & Klein, 2007) [14]. Developmental research is appropriate for this study as it supports the iterative creation and assessment of the Automated School Uniform Detection System. As the Software Development Life Cycle (SDLC) model, the Agile Development Model was adopted, which facilitates adaptive planning and continuous feedback through short, manageable sprints.

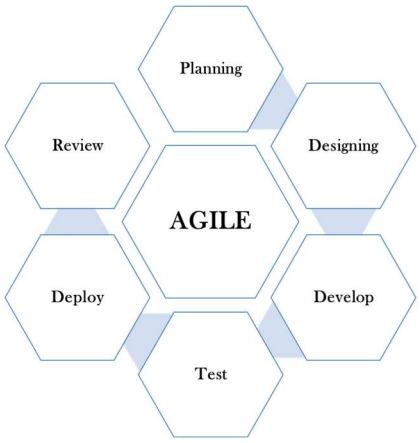

Figure 1. Agile Development Model.

C. Requirements and Planning:

Requirements were gathered through frequent collaborative group discussions to understand user needs. Functional requirements included real-time detection and data recording, while non-functional requirements addressed system performance and usability. Feasibility studies focused on hardware performance and the ability of YOLOv5 to process visual data with minimal delay.

D. System Design and Architecture:

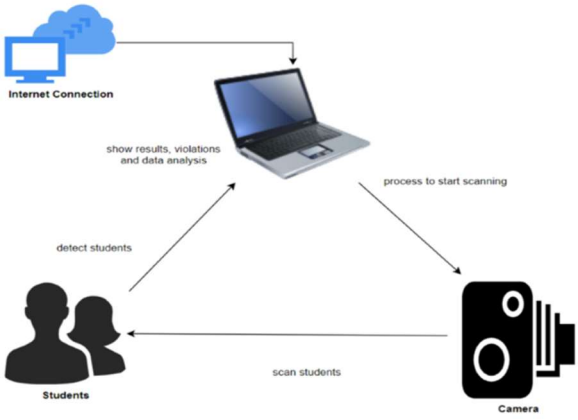

Figure 2. System Architecture

1);Hardware: The system utilizes an ESP32-CAM as a stationary image capture device. Data transfer is handled

via a TTL FTDI 2323RL and a USB 2.0 Type-A to Mini USB cable.

2);Software: Python was selected for its extensive ecosystem of libraries for machine learning. The YOLOv5 algorithm was chosen for its lightweight architecture and high-speed, accurate object detection capabilities. OpenCV was integrated for image reprocessing, such as re-sizing and filtering, to prepare data for detection.

E. Evaluation Framework:

Quality was evaluated by three IT experts and an engineer using the ISO/IEC 25010 Software Quality Model[12] to measure reliability and performance efficiency. User satisfaction was measured via the USE Questionnaire based on the work of Lund (2001) [13].

F. Semi-Pilot Testing:

A semi-pilot test was conducted to validate the system's real-world performance prior to full deployment. As shown in Figure 3, students were observed passing through the campus entry point while the automated detection system was in operation, demonstrating the system's capability to identify uniform compliance in an actual school environment. This preliminary testing confirmed that the system can be anticipated as a functional and existing solution for institutional monitoring.

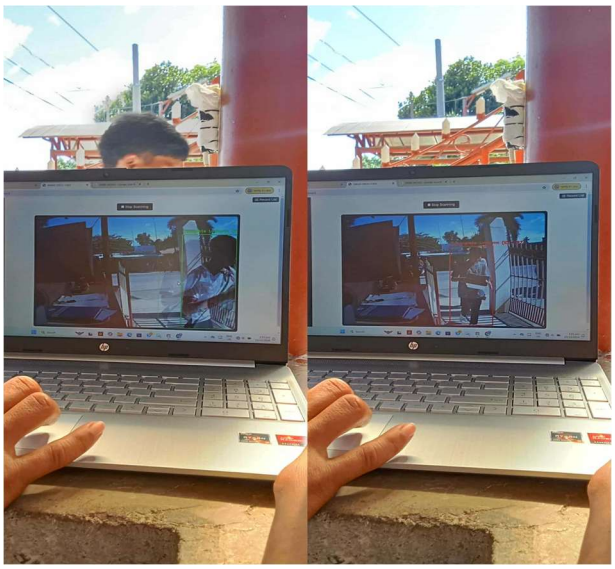

Figure 3. Students passing through the campus entry while wearing school uniforms during semi-pilot testing.

III. RESULTS

The system demonstrated high functional performance across all evaluated areas.

TABLE I

IN TERMS OF ENHANCING DISCIPLINE, UNIFORM COMPLIANCE, AND SCHOOL SECURITY.

	Mean	Verbal Interpretation
Improvement of discipline among students?	4.77	Highly Functional
Promotion of adherence to uniform policies.	4.90	Highly Functional
Enhancement of overall school security.	4.40	Highly Functional
Total	4.69	Highly Functional

Aspects of the System: The system achieved a "Highly Functional" score of 4.69 for improving student discipline, promoting adherence to uniform policies, and enhancing overall school security.

TABLE II

IN TERMS OF GENERATING FUNCTIONALITY OF THE AUTOMATED SCHOOL UNIFORM DETECTION SYSTEM.

	Mean	Verbal Interpretation
Verification of the completeness of the uniform upon entering the campus.	4.92	Highly Functional
Identification of the color of the uniform.	4.84	Highly Functional
Utilization of real-time processing to promptly detect any uniform violations.	4.67	Highly Functional
Display of information regarding students' violations.	4.95	Highly Functional
Counting of students entering the school wearing complete and not complete uniform.	4.87	Highly Functional
Recording of students entering the school wearing complete and not complete uniform.	4.87	Highly Functional
Total	4.85	Highly Functional

Functional Suitability: The system achieved a "Highly Functional" score of 4.89 for verifying uniform completeness, identifying colors, and recording data.

Dashboard and Processing: Displaying daily record lists and real-time processing of violations were rated at 4.67.

TABLE III

IN TERMS OF USEFULNESS, EASE OF USE, EASE OF LEARNING AND SATISFACTION.

Criteria	Mean	Verbal Interpretation
Usefulness	4.63	Agree
Ease of Use	4.70	Agree
Ease of Learning	4.92	Agree
Satisfaction	4.52	Agree
Total	4.69	Agree

User Experience: The system received an overall satisfaction rating of 4.69 from the USE Questionnaire, with "Ease of Learning" scoring highest at 4.92.

TABLE IV

IN TERMS OF THE CHARACTERISTICS SET IN ISO 2501.

Criteria	Mean	Verbal Interpretation

Functional Suitability	4.56	Good
Performance Efficiency	4.67	Good
Compatibility	4.67	Good
Reliability	4.83	Good
Security	4.67	Good
Total	4.68	Good

Overall Quality: Based on ISO/IEC 25010, the system scored an average of 4.68, indicating high reliability (4.83) and performance efficiency (4.67).

IV. DISCUSSION

The evaluation results indicate that the Automated School Uniform Detection System effectively transitions campus monitoring from a subjective, manual process to an objective, data-driven framework. The perfect functional scores in uniform color and completeness verification suggest that the YOLOv5 algorithm is highly reliable for institutional governance, successfully identifying compliance factors that human monitors might overlook due to fatigue or high student volume [1]. Furthermore, the high user satisfaction rating of 4.69 implies that the system's dashboard is intuitive and significantly reduces the cognitive load on administrative staff, addressing the core problem of staff burnout identified in the literature [8]. While minor latency in real-time updates was noted, the overall performance efficiency of 4.67 confirms that the integration of low-cost hardware like the ESP32-CAM is a viable and cost-effective solution for schools looking to enhance security without massive infrastructure investments.

V. IMPLICATION

Implementing this technology at Madridejos Community College streamlines administrative operations, allowing staff to refocus on teaching rather than policing dress codes. It fosters a culture of discipline by providing instant, transparent feedback on compliance through a user-friendly dashboard.

VI. LIMITATION

The system's effectiveness is reduced in strong back-lighting conditions, which can obscure uniform details. Additionally, the current hardware is stationary and not waterproof, requiring careful placement in sheltered, fixed entry points.

VII. CONCLUSION

The Automated School Uniform Detection System significantly benefits Madridejos Community College by streamlining administrative operations and record management. It provides an objective alternative to manual checks, fostering a culture of compliance and security. Future development should focus on enhancing dashboard precision and improving camera quality for better detection in various lighting conditions.

ACKNOWLEDGEMENT

The authors express their deepest gratitude to God and to their families for their unwavering financial and emotional support throughout this journey. We also acknowledge the faculty of the Information Technology Department at Madridejos Community College for their guidance.

REFERENCES

[1] Blue, S. T., & Brindha, M. (2019). Edge detection-based boundary box construction algorithm for improving the precision of object detection in YOLOv3. In 2019 10th International Conference on Computing, Communication and Networking Technologies (ICCCNT) (pp. 1–6). IEEE. https://doi.org/10.1109/ICCCNT45670.2019.8944852

[2] Sunil, & Gagandeep. (2019). Study of object detection methods and applications on digital images. International Journal of Scientific Development and Research (IJSDR), 4(5), 53–58. https://www.ijsdr.org/papers/IJSDR1905088.pdf

[3] Railkar, Y., Nasikkar, A., Pawar, S., Patil, P., & Pise, R. (2023). Object detection and recognition system using deep learning method. In 2023 2nd International Conference on Applied Artificial Intelligence and Computing (ICAAIC) (pp. 1475–1479). https://ieeexplore.ieee.org/document/10126316

[4] Redmon, J., & Farhadi, A. (2018). YOLOv3: An incremental improvement. arXiv. https://doi.org/10.48550/arXiv.1804.02767

[5] Ababou, N., Maafiri, A., Mohamed, A., & El Mohadab, M. (2023). Android-based attendance management system. In Digital technologies and applications (pp. 317–326). https://www.researchgate.net/publication/370526864

[6] Dattu, A., Ashish, P., Dhruv, M., & Prashant, G. (2024). An automated approach for classroom attendance using OpenCV. International Journal for Research in Applied Science and Engineering Technology, 12(5), 1289–1294. https://doi.org/10.22214/ijraset.2024.61799

[7] Smith, J., & Jones, M. (2022). Challenges in manual record-keeping for institutional security. International Journal of Cybersecurity, 18, 321-345. https://www.scirp.org/reference/referencespapers?referenceid=4198843

[8] Kanwal, A., Rafiq, S., & Afzal, A. (2023). Impact of workload on teachers' efficiency and their students' academic achievement at the university level. Gomal University Journal of Research, 39(2), 131–146. https://doi.org/10.51380/gujr-39-02-02

[9] Matthew, B., & Michael, I. (2025, June). Psychological effects of continuous monitoring. Journal of Information Technology and Digital World. https://www.researchgate.net/publication/393374094

[10] Vaduganathan, D., Annapurna, T., Aswitha, U., & Brindha, D. (2024). AI based Identification of Students Dress Code in Schools and Universities. Journal of Information Technology and Digital World, 6(1), 1-11. https://doi.org/10.36548/jitdw.2024.1.001

[11] Abad, Jhon Lloyd ; Barzo, Shan Michael ; Fajardo, Jan Aron; Reginald S. Prudente; Joseph M. Buquis; Kenmark T. Celis. “Machine Learning: School Uniform Detection System.” Volume. 10 Issue.5, May-2025 International Journal of Innovative Science and Research Technology (IJISRT), 858-879, https://doi.org/10.38124/ijisrt/25may1106

[12] International Organization for Standardization. (2011). ISO/IEC 25010:2011 systems and software engineering—systems and software quality requirements and evaluation (SQuaRE): System and software quality models. ISO. https://www.iso.org/standard/35733.html

[13] Lund, A. M. (2001). Measuring usability with the USE questionnaire. Usability Interface, 8(2), 3–6. https://garyperlman.com/quest/quest.cgi?form=USE

[14] Richey, R. C., & Klein, J. D. (2007). Design and development research: Methods, strategies, and issues. Lawrence Erlbaum Associates. https://doi.org/10.4324/9780203826034

