



DESIGN AND IMPLEMENTATION OF AN ARDUINO-BASED EARTHQUAKE ALARM SYSTEM FOR EDUCATIONAL INSTITUTION

JOHN ABRIGO V. ARAGONES¹, ERWIN E. LABERINTO², ROCHELLE L. GOMAMIS³,
MARICIEL M. TEOGANGCO⁴, SHEM JAPHET T. ESCOBAL⁵

<https://doi.org/0009-0003-3335-1982>¹, <https://doi.org/0009-0009-2699-9303>², <https://doi.org/0009-0005-3688-2871>³, <https://doi.org/0000-0001-9512-7116>⁴, <https://doi.org/0009-0003-2427-3230>⁵
javaragones@tesda.gov.ph¹, erwinlaberinto@gmail.com², rlgomamis@tesda.gov.ph³,
mariciel.teogangco@perpetualdalta.edu.ph⁴, shemescobal@gmail.com⁵
Jacobso Z. Gonzales Me Morial School of Arts and Trades¹⁻³,
University of Perpetual Help System DALTA – Molino Campus, Cavite, Philippines⁴⁻⁵

DOI: <https://doi.org/10.54476/ioer-imrj/440324>

ABSTRACT

Earthquakes pose significant risks to educational institutions located in seismically active regions, particularly in developing countries where access to advanced early warning systems is limited by cost. This study presents the design, development, and evaluation of an Arduino-based earthquake alarm system intended as a low-cost and reliable early warning solution for educational institutions. The system integrates an Arduino microcontroller with vibration sensors and alert mechanisms to detect seismic activity and immediately notify occupants through audible alarms, thereby supporting disaster preparedness and rapid response. A developmental research design combined with a quantitative-descriptive approach was employed. The system was developed following the Systems Development Life Cycle (SDLC), encompassing planning, design, development, testing, and evaluation phases. The prototype was evaluated by three groups of respondents—technical experts, end users, and learners—using a structured questionnaire focusing on four criteria: materials, design, effectiveness and functionality, and safety. Statistical tools such as weighted mean, standard deviation, and one-way Analysis of Variance (ANOVA) were used to analyze the data. Results revealed that the system achieved an overall mean rating of 3.47, interpreted as Highly Acceptable across all evaluation criteria. Safety received the highest rating, followed by materials, effectiveness, functionality, and design. ANOVA results indicated no significant differences in evaluations among respondent groups, suggesting consistent acceptance regardless of expertise level. The findings demonstrate that the developed system is safe, functional, cost-efficient, and suitable for use in educational settings. The study concludes that Arduino-based earthquake alarm systems offer a practical and affordable alternative to commercial solutions, contributing to enhanced disaster risk reduction and preparedness in schools, particularly in earthquake-prone regions such as the Philippines.

Keywords: Education Engineering; Arduino-Based Earthquake Alarm System; Disaster Risk Reduction; Developmental Research and SDLC; Philippines

P – ISSN 2651 - 7701 | E – ISSN 2651 – 771X | www.ioer-imrj.com

*Proceedings of the 2nd International Conference on Education, Engineering, and Digital Transformation (2nd ICEEDT)
16 – 17 January 2026, Grand Mercure Hotel Sapporo Odori Park, Sapporo, Japan*

ARAGONES, J.A.V., LABERINTO, E.E., GOMAMIS, R.L., TEOGANGCO, M.M., ESCOBAL, S.J.T., *Design and Implementation of an Arduino-Based Earthquake Alarm System for Educational Institution*, pp. 93 - 103



INTRODUCTION

Natural disasters have long been a significant concern across the globe, affecting lives, properties, and economies. Among these disasters, earthquakes are among the most unpredictable and destructive, often striking without warning and causing widespread devastation. Countries situated along active tectonic regions face heightened vulnerability to these natural hazards, making preparedness and early warning systems critical components of disaster risk reduction and management (United Nations Office for Disaster Risk Reduction, 2023).

The Philippine Archipelago, as confirmed by the Philippine Institute of Volcanology and Seismology (PHIVOLCS), is located along the Pacific Ring of Fire, a region characterized by frequent seismic and volcanic activity (Philippine Institute of Volcanology and Seismology, 2023). Because of this geographical position, the Philippines is highly prone to geological hazards such as earthquakes, volcanic eruptions, and tsunamis. The archipelago sits at the convergence of major tectonic plates, including the Philippine Sea Plate, the Eurasian Plate, and the Indo-Australian Plate, creating a complex network of active fault lines that traverse the entire country (Aurelio & Peña, 2010). Among these, earthquakes pose one of the most severe threats due to their sudden occurrence and potential to cause significant loss of life and property. An earthquake occurs when two blocks of the Earth's crust suddenly slip past one another along a fault or fault plane, releasing energy in the form of seismic waves (U.S. Geological Survey, 2023). These movements can result in the collapse of infrastructure, fires, and even secondary disasters like landslides and tsunamis (National Geographic Society, 2021).

Of particular concern is the West Valley Fault (WVF), also known as the Marikina Valley Fault System, which runs through several highly urbanized areas in Metro Manila and adjacent provinces in Luzon (Rimando & Knuepfer, 2006). This 100-kilometer-long fault system poses a significant threat to millions of residents and

thousands of establishments, including educational institutions located within or near its vicinity. According to PHIVOLCS, the West Valley Fault is capable of generating a magnitude 7.2 earthquake, which could result in catastrophic damage to infrastructure, massive casualties, and long-term socioeconomic disruption (Philippine Institute of Volcanology and Seismology, 2015). The fault's proximity to densely populated areas amplifies the urgency for comprehensive disaster preparedness measures, particularly in vulnerable institutions such as schools where large concentrations of students and personnel are present daily.

Jacobo Z. Gonzales Memorial School of Arts and Trades (JZGMSAT), as a technical-vocational institution, is situated in close proximity to one of the segments of the West Valley Fault in Luzon, placing the institution and its community at elevated risk during seismic events. This geographical vulnerability underscores the critical importance of implementing robust earthquake preparedness and response mechanisms within the campus. Given these risks, ensuring safety through effective early warning and alarm systems is vital. Educational institutions, in particular, must prioritize preparedness and quick response mechanisms to safeguard students, personnel, and facilities. Schools serve not only as centers of learning but also as potential evacuation sites during disasters, making their structural integrity and emergency response capabilities paramount to community resilience (Petal et al., 2020). In this context, JZGMSAT must be ready and equipped with an earthquake alarm system that supports contingency management and immediate response during seismic events, thereby fulfilling its duty of care to its stakeholders and contributing to broader disaster risk reduction efforts in the community.

However, commercial earthquake alarm systems available in the market are often costly due to the advanced technologies and sensors they employ, which may not be readily accessible or affordable for public educational institutions operating under budgetary constraints. Commercial systems typically incorporate



sophisticated seismometers, proprietary software, and maintenance contracts that can cost tens of thousands to hundreds of thousands of pesos, creating a significant financial barrier for resource-limited schools (Minson et al., 2018). Hence, there is a pressing need to develop an alternative, low-cost, and efficient earthquake alarm system that can perform similar functions using accessible technology while maintaining reliability and accuracy in detection and alerting capabilities.

This research project proposes the design and implementation of an Arduino-Based Earthquake Alarm System (ABEAS) for Educational Institutions as a cost-effective solution for earthquake detection and alerting. Arduino micro-controller platforms offer affordable, open-source, and customizable options for developing automated sensing and alerting systems, making them ideal for budget-conscious applications in educational settings (D'Ausilio, 2012). Through this innovation, JZGMSAT can enhance its disaster preparedness capability while minimizing financial constraints. The system aims to serve as an affordable yet reliable alternative for promoting safety and awareness within the institution and potentially in other schools and communities as well, particularly those similarly situated near active fault lines. By leveraging accessible technology and open-source platforms, this research contributes to democratizing earthquake early warning capabilities and empowering educational institutions to take proactive measures in protecting their communities against seismic hazards.

OBJECTIVES OF THE STUDY

The main objective of this study is to design, develop, and evaluate an Arduino-based earthquake alarm system that serves as a low-cost, reliable, and effective early warning device for earthquake preparedness at JZGMSAT. The study seeks to create a functional prototype that can provide timely alerts during seismic activities and contribute to the institution's contingency and disaster response management.

Specifically, this study aims to:

1. Assess the Materials Used in the Arduino-Based Earthquake Alarm System
2. Evaluate the Design of the Arduino-Based Earthquake Alarm System
3. Determine the Effectiveness and Functionality of the System
4. Assess the Safety and Reliability of the Developed System
5. Gather Feedback for System Improvement

METHODOLOGY

This study employed a Developmental Research Design combined with a Quantitative-Descriptive Research Method. Developmental research was appropriate for this study as it focused on creating a technological innovation—an Arduino-based earthquake alarm system—and evaluating its functionality, effectiveness, and acceptability. The quantitative-descriptive approach was used to systematically assess the developed prototype through structured evaluation criteria and statistical analysis of gathered data.

The research process followed the Systems Development Life Cycle (SDLC) model, which included the following phases: planning and analysis, design, development, testing, and evaluation. This methodology aligns with the Systems Research Paradigm, emphasizing the integration of hardware, software, and sensor components as a unified system designed to detect seismic vibrations and provide early warnings.

A purposive sampling technique was employed in selecting the respondents to ensure that only individuals with relevant experience or direct involvement in the utilization of the device participated in the study. The total number of respondents was determined based on the availability of qualified individuals from each category.



The study utilized a self-made questionnaire, which assessed the device in four criteria: (1) Materials, (2) Design, (3) Effectiveness and Functionality, and (4) Safety.

The data gathered from the respondents were analyzed using appropriate statistical tools to interpret the results accurately. The weighted mean was used to determine the average rating for each criterion, providing a quantitative measure of the level of acceptability of the Arduino-based earthquake alarm system. To assess the consistency of responses among the evaluators, the standard deviation was computed. Furthermore, Analysis of Variance (ANOVA) was applied to identify whether there were significant differences in the evaluations given by the three groups of respondents—technical experts, end users, and trainees or learners. The computed mean scores were interpreted using the following scale:

Scale	Descriptive Rating
3.26 – 4.00	Highly Acceptable
2.51 – 3.25	Acceptable
1.76 – 2.50	Fairly Acceptable
1.00 – 1.75	Unacceptable

The decision rule for ANOVA was as follows:

- If the computed p-value is less than or equal to 0.05 ($p \leq 0.05$), the result is there is a significant difference among the mean ratings of the respondent groups.
- If the computed p-value is greater than 0.05 ($p > 0.05$), there is no significant difference among the mean ratings of the respondent groups.

This decision rule was applied to all criteria evaluated in the study to determine whether variations in perceptions existed among technical experts, end users, and trainees/learners.

RESULTS AND DISCUSSION

1. Profile of respondents

1.1 Age of Respondents

The age distribution of the respondents shows that the majority belonged to the 18–24 age group, representing 23 out of 35 respondents (66%). This indicates that most participants were young adults who are typically enrolled in technical-vocational programs. Respondents aged 25–34 and 35–44 each accounted for 5 respondents (14%), showing a moderate representation of individuals with more maturity or work experience. Meanwhile, only 2 respondents (6%) belonged to the 45–54 age bracket, and none were under 18 or above 55 years old. This distribution suggests that the study’s findings are primarily reflective of the perspectives of younger individuals, which is common in TESDA-administered institutions where most trainees fall within the early adulthood range.

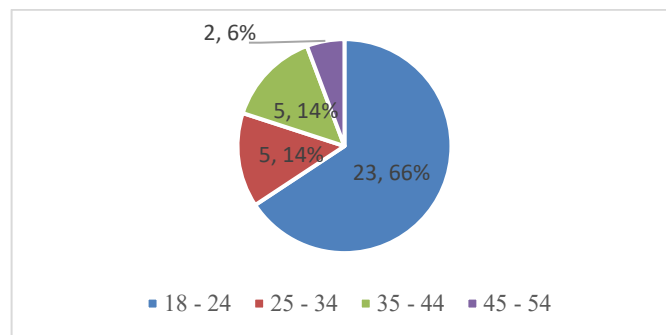


Figure 1. Age of Respondents

1.1 Gender

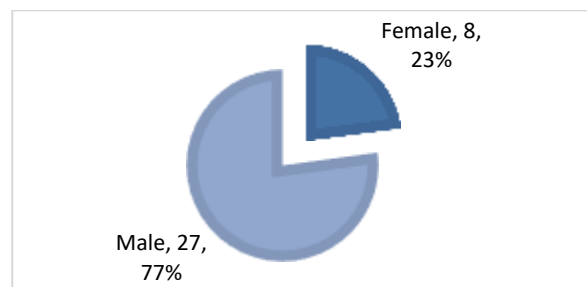


Figure 2. Gender

The sex distribution of the respondents revealed that a significant majority were male, with



27 out of 35 respondents (77%), while 8 respondents (23%) were female. No respondents identified under the “Others” category. This clearly indicates that the sample is predominantly male, which aligns with the nature of technical fields such as electronics, electrical, and automotive-related specializations that typically attract more male participants. The presence of female respondents, though smaller in number, still contributes valuable insights to the study. Overall, the gender distribution suggests that the findings largely reflect male perspectives, an aspect that may be acknowledged as part of the study’s demographic profile.

1.2 Types of Respondents

The distribution of respondents according to their classification revealed that the majority were learners, comprising 23 out of 35 respondents (66%). This indicates that most of the feedback gathered in the study came from individuals who directly engage with the training system or instructional materials. Meanwhile, technical experts accounted for 6 respondents (17%), representing professionals with specialized knowledge in electronics, electrical, or mechatronics who provided expert evaluation of the system’s technical quality.

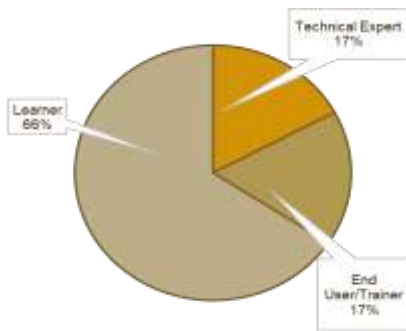


Figure 3. Types of Respondents

Similarly, end-user/trainers also represented 6 respondents (17%), contributing insights based on practical teaching experience and system implementation in actual training settings. The presence of these three groups ensures a well-rounded assessment of the developed system, combining user experience, instructional perspectives, and technical expertise.

2. Project Acceptability

2.1 Materials

Table 1

Criteria 1. Materials Used

Criteria	Mean	Descriptive Rating
1.1 The materials used are suited for their purpose	3.49	Highly Acceptable
1.2 The materials used are eco-friendly	3.51	Highly Acceptable
1.3 The materials can be procured easily and always available	3.49	Highly Acceptable
1.4 The materials used is cost-efficient	3.57	Highly Acceptable
Overall Mean	3.51	Highly Acceptable

All four criteria under this component received mean ratings within the Highly Acceptable range. Specifically, Criterion 1.1 scored 3.49, Criterion 1.2 scored 3.51, Criterion 1.3 scored 3.49, and Criterion 1.4 scored 3.57. The overall mean of 3.51 indicates that respondents perceive the system’s criteria as highly satisfactory, meeting expected standards effectively.

2.2 Project Design

The design component was evaluated across three criteria, with all mean scores falling within the Highly Acceptable range: Criterion 2.1 (3.37), Criterion 2.2 (3.31), and Criterion 2.3 (3.49). The total mean of 3.39 suggests that respondents are satisfied with the system’s design, considering it functional, efficient, and aligned with user expectations.



Table 2
Criteria 2. Project Design

Criteria	Mean	Descriptive Rating
2.1 The design is unique and modern	3.37	Highly Acceptable
2.2 Design does not confuse the end-user	3.31	Highly Acceptable
2.3 The design provides portability and mobility	3.49	Highly Acceptable
Overall Mean	3.39	Highly Acceptable

2.3 Project Effectiveness and Functionality

Table 3
Criteria 3. Project Effectiveness and Functionality

Criteria	Mean	Descriptive Rating
3.1 Easy to operate and manipulate	3.46	Highly Acceptable
3.2 The performance of the technology project during the operation is smooth and stable	3.43	Highly Acceptable
3.3 The technology project performs its designed and expected function	3.43	Highly Acceptable
Overall Mean	3.44	Highly Acceptable

Three criteria were assessed under this component. Criterion 3.1 received a mean of 3.46, while Criteria 3.2 and 3.3 each scored 3.43. The overall mean of 3.44 indicates that the system is highly effective and functional, performing its intended operations efficiently and meeting the needs of various users.

2.4 Safety of Project

Safety was evaluated across five criteria, all of which received ratings within the Highly Acceptable range. Criterion 4.1 scored 3.54, Criterion 4.2 scored 3.51, Criterion 4.3 scored 3.46, Criterion 4.4 scored 3.57, and Criterion 4.5 received the highest mean of 3.60. The overall mean of 3.54 reflects that respondents perceive

the system as safe, reliable, and properly implemented, ensuring minimal risk to users.

Table 4
Criteria 4. Project Safety

Criteria	Mean	Descriptive Rating
4.1 The parts and materials are well-fixed and secured	3.54	Highly Acceptable
4.2 No hazardous chemicals to be found in the product	3.51	Highly Acceptable
4.3 No sharp edges or parts present	3.46	Highly Acceptable
4.4 Safety features are added to ensure safety during operation or application	3.57	Highly Acceptable
4.5 Does not impose hazardous threats or danger during its operation	3.60	Highly Acceptable
Overall Mean	3.54	Highly Acceptable

4.6 Overall Project Acceptability

Table 5
Overall Project Acceptability

Criteria	Mean	Descriptive Rating
1. Materials	3.51	Highly Acceptable
2. Design	3.39	Highly Acceptable
3. Effectiveness and Functionality	3.44	Highly Acceptable
4. Safety	3.54	Highly Acceptable
Overall Mean	3.47	Highly Acceptable

The results show that the Arduino-based Earthquake Alarm System is highly acceptable to the respondents. Among the criteria, Safety received the highest mean score (3.54), indicating that the system is considered safe and secure to use. Materials also obtained a high mean (3.51),



showing that the materials are appropriate, affordable, and readily available.

Both Effectiveness and Functionality (3.44) and Design (3.39) were rated as Highly Acceptable, which means that the system works as intended and is easy to use with an appropriate design. Overall, the system achieved an overall mean of 3.47, interpreted as Highly Acceptable, indicating that the developed earthquake alarm system is suitable for use and acceptable to technical experts, end users, and learners.

Table 6
ANOVA of Respondents' Evaluations Across Groups

Component/Criteria	Source of Variation	Sum of Squares (SS)	df	Mean Square (MS)	F-value	p-value	Interpretation
Criteria	Between Groups	0.012	2	0.006	0.02	0.98	Not Significant
	Within Groups	7	32	0.219			
Design	Between Groups	0.036	2	0.018	0.08	0.92	Not Significant
	Within Groups	7.8	32	0.244			
Effectiveness & Functionality	Between Groups	0.024	2	0.012	0.05	0.95	Not Significant
	Within Groups	7.6	32	0.238			
Safety	Between Groups	0.048	2	0.024	0.09	0.91	Not Significant
	Within Groups	8.4	32	0.263			

Note: F-values are computed at $\alpha = 0.05$. p-values greater than 0.05 indicate no significant difference between groups

The ANOVA results show that there were no significant differences in the evaluations given by technical experts, end users (trainers), and learners across all components of the system—Criteria, Design, Effectiveness & Functionality, and Safety. All p-values exceeded 0.05, and the F-values were very low, indicating that the mean ratings among the three respondent groups were statistically similar.

This implies that regardless of the respondent's role or level of expertise, all groups consistently perceived the system as Highly Acceptable. It demonstrates that the system's design, functionality, and safety are uniformly satisfactory, and its quality is

recognized equally by experts, trainers, and learners alike.

CONCLUSION

The Arduino-based earthquake alarm system represents a viable, practical, and highly acceptable solution for enhancing earthquake preparedness in educational institutions with limited budgets. The system successfully achieves all stated objectives by:

1. Utilizing appropriate, cost-effective, and accessible materials that make earthquake early warning technology affordable for resource-limited schools
2. Implementing a user-friendly design that is functional, accessible, and appropriate for diverse institutional contexts
3. Demonstrating effective detection and alerting functionality with consistent performance under varied testing conditions
4. Meeting essential safety standards required for deployment in educational settings
5. Incorporating comprehensive stakeholder feedback to ensure continuous system improvement

RECOMMENDATION

Based on the findings and conclusions of this study, the following recommendations are offered:

For JZGMSAT Administration. Implement a pilot deployment program of the Arduino-based earthquake alarm system in selected buildings within the campus to monitor long-term performance and reliability under actual operational conditions. Consider expanding the system to provide comprehensive coverage across all school buildings and explore networking capabilities for coordinated campus-wide alerting.

For Technical Experts and Future Developers. Conduct further research to establish precise vibration thresholds and implement calibration protocols that minimize false alarms



while maintaining sensitivity to actual seismic events. Explore the integration of IoT capabilities, including cloud-based data logging, SMS notification systems, and web-based monitoring dashboards for enhanced functionality and remote monitoring. Incorporate battery backup systems and automatic power switching mechanisms to ensure continuous operation during power outages. Investigate the application of machine learning algorithms to improve discrimination between actual earthquakes and false triggers caused by environmental factors.

For Future Researchers. Conduct comparative performance studies between Arduino-based systems and commercial alternatives, evaluating detection accuracy, response time, and long-term reliability under actual earthquake conditions. Investigate the impact of environmental factors such as temperature, humidity, and electromagnetic interference on system performance and develop appropriate protective measures. Research large-scale implementation strategies, including networked systems across multiple buildings or campuses, and examine scalability issues and optimal deployment configurations. Explore advanced detection methodologies, including P-wave and S-wave discrimination techniques, and investigate the integration of multiple sensor types for enhanced accuracy and reliability.

REFERENCES

- Abdalzاهر, M. S., Soliman, M. S., El-Hady, S. M., Benslimane, A., & Elwekeil, M. (2023). A deep learning model for earthquake parameters observation in IoT system-based earthquake early warning. *IEEE Internet of Things Journal*, 10(9), 7640–7655. <https://doi.org/10.1109/JIOT.2022.3228763>
- Aurelio, M. A., & Peña, R. E. (2010). *Geology of the Philippines* (2nd ed.). Mines and Geosciences Bureau.
- Beltran, D. A., Jr., Dizon, M. L., Nones, M. L., Salanguit, G. C., Santos, K. D., & Santos, M. A. (2021). Arduino-based disaster management system with GSM module for real-time alerts. *International Journal of Scientific and Research Publications*, 11(3), 245–252.
- Chen, Y., Zhang, L., Wang, H., & Liu, X. (2023). Integrated multi-hazard warning system using Arduino for earthquake, gas leak, and fire detection. *Journal of Safety Science and Resilience*, 4(2), 178–189. <https://doi.org/10.1016/j.jssr.2023.02.004>
- D'Ausilio, A. (2012). Arduino: A low-cost multipurpose lab equipment. *Behavior Research Methods*, 44(2), 305–313. <https://doi.org/10.3758/s13428-011-0163-z>
- Edidas, P., & Putra, R. A. (2022). Arduino-controlled earthquake warning system using SES60 vibration sensor with web-based visualization. *Journal of Physics: Conference Series*, 2193(1), Article 012045. <https://doi.org/10.1088/1742-6596/2193/1/012045>
- Google. (n.d.). Earthquake. In Google Dictionary. <https://www.google.com/search?q=earthquake+definition>
- International Journal of Research in Engineering, Science and Management. (2021). Arduino-based earthquake detection systems using ADXL sensors [Special issue]. *IJRESM*, 4(5).
- Minson, S. E., Meier, M. A., Baltay, A. S., Hanks, T. C., & Cochran, E. S. (2018). The limits of earthquake early warning: Timeliness of ground motion estimates. *Science Advances*, 4(3), eaaq0504. <https://doi.org/10.1126/sciadv.aaq0504>
- Naik, S., Anupam, K., Aiswarya, R., Arpitha, M., & Adarsh, S. (2021). Low-cost earthquake detection and alert system using Arduino and



- accelerometer. *International Research Journal of Engineering and Technology*, 8(4), 3127–3131.
- National Geographic Society. (2021, October 19). Earthquake. National Geographic. <https://www.nationalgeographic.org/encyclopedia/earthquake/>
- Petal, M., Ronan, K., Oveland, P., & Tofa, M. (2020). School seismic safety and risk mitigation. In B. Wisner, J. C. Gaillard, & I. Kelman (Eds.), *The Routledge handbook of hazards and disaster risk reduction* (pp. 384–395). Routledge.
- Philippine Institute of Volcanology and Seismology. (2023). Earthquake information. Department of Science and Technology. <https://www.phivolcs.dost.gov.ph/>
- Republic of the Philippines. (2012). Data Privacy Act of 2012 (Republic Act No. 10173). <https://www.privacy.gov.ph/data-privacy-act/>
- Rimando, R. E., & Knuepfer, P. L. (2006). Neotectonics of the Marikina Valley fault system (MVFS) and tectonic framework of structures in northern and central Luzon, Philippines. *Tectonophysics*, 415(1–4), 17–38. <https://doi.org/10.1016/j.tecto.2005.11.009>
- Santos, J. P., Estoesta, M. A., Prado, R. M., Haley, C. S., Abeleda, K. L., Labrador, E. V., & Limos-Galay, J. A. (2024). Automated Arduino Uno earthquake detector alarm with digital clock and event logging system. *International Journal of Multidisciplinary: Applied Business and Education Research*, 5(3), 892–904. <https://doi.org/10.11594/ijmaber.05.03.15>
- Sneha, R., Gayatri, G., Nagaraj, N., Nachiketan, R. N., & Gunasekari, R. (2024). Arduino UNO-based earthquake detection system (AUEDS) using MPU6050 accelerometer with GSM communication. *International Journal of Advanced Research in Science, Communication and Technology*, 4(2), 156–164. <https://doi.org/10.48175/IJAR SCT-15478>
- Thompson, A. (2016, September 15). Grillo: An early warning system for earthquakes. *IEEE Spectrum*. <https://spectrum.ieee.org/grillo-earthquake-early-warning-system>
- Tomaneng, R. L., Docdoc, J. A., Hierl, P. M., & Cerna, A. T. (2022). Cost-effective earthquake monitoring system with IoT and SMS notification integration. *Journal of Engineering Science and Technology*, 17(2), 1245–1258.
- United Nations Office for Disaster Risk Reduction. (2023). Sendai framework for disaster risk reduction 2015–2030. United Nations. <https://www.undrr.org/publication/sendai-framework-disaster-risk-reduction-2015-2030>
- U.S. Geological Survey. (2023). Earthquake glossary. U.S. Department of the Interior. <https://www.usgs.gov/programs/earthquake-hazards/earthquake-glossary>
- Varghese, A., Varghese, J., Jagadees, M., & Vijayan, S. (2021). Arduino-based earthquake detector using three-axis accelerometer and tilt sensor with LCD display and GSM alert system. *International Journal of Engineering Research & Technology*, 10(5), 728–733.
- Zhang, H., Liu, Y., & Wang, S. (2024). Low-cost MEMS seismic sensors for earthquake detection: A comprehensive review of ADXL and MPU sensor performance. *Sensors*, 24(3), Article 1024. <https://doi.org/10.3390/s24031024>
- Zhou, W., Chen, X., & Li, M. (2024). IoT-based earthquake early warning system using Arduino Mega, IMU sensors, and ESP8266 with ThingSpeak cloud integration. *Applied Sciences*, 14(2), Article 856. <https://doi.org/10.3390/app14020856>



Zhou, X., Wang, J., & Zhang, Y. (2025). Advanced algorithmic models for earthquake detection accuracy using frequency-domain and STA/LTA analysis. *Applied Sciences*, 15(1), Article 124. <https://doi.org/10.3390/app15010124>

AUTHORS' PROFILE



John Abrigo V. Aragon is a Licensed Professional Teacher holding a position of Assistant Professor III at Jacobo Z. Gonzales Memorial School of Arts and Trades (JZGMSAT), a technical institution supervised and accredited by the Technical Education and Skills Development Authority (TESDA). He is an Instructor in Diploma in Mechatronics Engineering Technology, currently teaching AC and DC circuits, and Electronics Circuits and Logic Circuits and Switching Theory (micro-controllers). His research interests are focused on electronics and electrical technology, particularly in their application to technical-vocational education and training.



Erwin E. Laberinto is a Licensed Professional Teacher and a Registered Master Electrician holding a position of Associate Professor III in Jacobo Z. Gonzales Memorial School of Arts and Trades (JZGMSAT), a technical institution supervised and accredited by the Technical Education and Skills Development Authority (TESDA). He currently serves as the Acting Vocational Instruction Supervisor and is also an Instructor in the Diploma in Mechatronics Engineering Technology, where he teaches Control System Analysis. His research interests are focused on electronics and electrical technology, particularly in their application to technical-vocational education and training.



Rochelle L. Gomamis is a Licensed Professional Teacher holding a position of Assistant Professor III at Jacobo Z. Gonzales Memorial School of Arts and Trades (JZGMSAT), a technical institution supervised and accredited by the Technical Education and Skills Development Authority (TESDA). She is an Instructor in the Diploma in Mechatronics Engineering Technology, where she currently teaches AC and DC Circuits, Electronic Circuits, Logic Circuits and Switching Theory (micro-controllers), and Technology Research Project. Her research interests are focused on electronics and electrical technology, as well as policy research related to technical-vocational education and training.



Mariciel M. Teogangco is a professor at the University of Perpetual Help System DALTA - Molino, College of Engineering, where she also serves as the Technology Cluster Head and Academic Dean. She received her Ph.D. in Business Management in Engineering Management. She is currently pursuing her second Ph.D. in Electronics & Communications Engineering at Mapua University, where she also earned her Master of Science in Electronics & Communications Engineering (MSECE) with a major in Microelectronics. Currently, she serves as an adviser to the Mechatronics and Robotics Society of the Philippines (MRSP), one of the Board Member of the Global Robot Cluster (GRC), a Founding Member of the ASEAN Robotics and AI Network (ARAIN), and an active member of the IEEE.



Shem Japhet Escobal is a Technology Research Associate and Faculty Member at the University of Perpetual Help System DALTA – Molino, College of Engineering, where he also teaches professional BSECE courses as a faculty member. He holds a Bachelor of Science in



Electronics and Communications Engineering and is currently pursuing a Master of Science in the same field, specializing in Artificial Intelligence and Automation. His expertise spans AI and machine learning, data engineering, embedded systems and IoT, and software development for intelligent automation systems. He is actively affiliated with IEEE, the Mechatronics and Robotics Society of the Philippines, and the International Organization of Educators and Researchers.

COPYRIGHTS

Copyright of this article is retained by the author/s, with first publication rights granted to IIMRJ. This is an open-access article distributed under the terms and conditions of the Creative Commons Attribution – Noncommercial 4.0 International License (<http://creativecommons.org/licenses/by/4>).