

## Design and Implementation of an Arduino-Based Earthquake Alarm System (ABEAS) for Educational Institutions

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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, 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