Privacy Governance-Driven Design of AI-Powered Elderly Safety Monitoring for Cambodia

Monireach Tang
Graduate School, Cambodia University of Technology and Science
monireach.tang@camtech.edu.kh
Seingheng Hul[1,2]
[1]Ministry of Industry, Science, Technology & Innovation
[2]Graduate School, Cambodia University of Technology & Science
hul.seingheng@misti.gov.kh
May Thu
Graduate School, Cambodia University of Technology and Science
may.thu@camtech.edu.kh

Abstract

Cambodia expects 14 to 20% of its population to be elderly by 2030, compounding existing healthcare challenges–physician shortages and geographic disparities, thus requiring improved safety monitoring. Traditional cloud-based systems transmit sensitive video footage to remote servers, creating surveillance risks for elderly individuals. This conceptual paper proposes a privacy-driven architectural framework grounded in Privacy by Design principles, embedding privacy protection elements from inception rather than retrofitting them afterward. The architecture comprises three RGB cameras and an NVIDIA Jetson Orin Nano edge platform, immediately converting videos to skeletal coordinates, storing only pose data while permanently deleting original footage. Processing integrates YOLOv8n person detection, MediaPipe pose estimation, and CNN-LSTM-Transformer hybrid for incident classification. The proposed design is structured to achieve 100% on-device processing with zero cloud transmission of sensitive data. Preliminary cost analysis suggests $600 one-time deployment versus $1,350-$1,950 annual cloud alternatives, potentially enabling access for an estimated 180,000 elderly in middle-income Cambodian urban households (representing the top 50% income bracket, calculated from Cambodia Socio-Economic Survey income data ("Cambodia Socio-Economic Survey 2021 | GHDx," n.d.) and 2030 elderly population projections). This research demonstrates that privacy governance can drive the technical architecture from inception, rather than being incorporated later, potentially achieving privacy preservation while improving the accessibility of advanced AI monitoring systems for Cambodian populations. Framework requires empirical validation through deployment using benchmark datasets to verify detection accuracy, alert latency, and system reliability.

Keywords: Accessibility, Privacy governance, Edge computing, Elderly safety monitoring, Developing countries, Cambodia, AI ethics, Healthcare AI

Paper Type: Conceptual Paper