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DESIGN AND DEVELOPMENT OF MOBILE APPLICATION FOR ASSESSING CRIME RISK FOR INVESTIGATION OFFICER (IO)

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ABSTRACT

This paper presents the design and development of the Integrated Crime Risk Assessment System (ICRAS), a mobile based, AI driven tool tailored specifically for Investigation Officers (IOs) in Malaysia. Recognizing the challenges faced by law enforcement personnel in dynamic and resource constrained environments, this study proposes a novel mobile application that integrates real time analytics with field operations, empowering IOs to assess and manage crime risk proactively. ICRAS is the first system of its kind in Malaysia, utilizing Light Gradient Boosting Machine (LightGBM) models for predictive crime risk assessment and geospatial hotspot mapping to visualize high risk areas. By seamlessly combining predictive analytics with field-based decision making, ICRAS enhances situational awareness and improves operational efficiency. This paper outlines the methodological framework for the development of ICRAS, analyses its performance, and discusses its potential to transform conventional policing into a more proactive, intelligence led model. Through extensive testing and user feedback, the results demonstrate significant improvements in decision making efficiency, resource allocation, and officer satisfaction. The research underscores the application's relevance in modernizing law enforcement tools and its alignment with national strategies to improve public safety.

Keywords: *Integrated Crime Risk Assessment System (ICRAS), Investigation Officers (IO), Predictive Analytics, Intelligence Led Policing, Mobile Application*

INTRODUCTION

In recent years, the complexity of crime has intensified, driven by socio economic pressures, urbanization, and the increasing sophistication of criminal tactics (Malik, A.A., 2016). In Malaysia, Investigation Officers (IOs) play a pivotal role in managing and mitigating crime at the ground level (Othman, S.Z., 2023). Current crime risk assessment methods rely on fragmented data and lack real time insights, which significantly hinder rapid decision making and effective resource allocation. Traditional methods are further obstructed by inconsistent methodologies and limited access to real time intelligence (Granite, GRC, 2025). This impedes the ability of IOs to respond swiftly and accurately, particularly in high stakes situations (Maidin, 2024). To address these challenges, this study introduces the Integrated Crime Risk Assessment System (ICRAS), a mobile application designed to bridge the gap between data science and frontline law enforcement (Lee, Tan, & Tan, 2022). The primary aim is to provide IOs with a digital companion capable of evaluating crime risk, mapping hotspots, and generating predictive insights using machine learning models (Singh, 2021). By digitizing and systematizing crime risk assessment, ICRAS represents a step forward in Malaysia's journey towards smart policing and improved public safety infrastructure (Kamaruddin, 2021).

METHODOLOGY

The development of ICRAS employed a mixed methods approach, combining qualitative input from law enforcement stakeholders with quantitative analysis of crime data. The research design followed a multi-phase process. Initially, a needs assessment was conducted through interviews and focus group discussions involving 30 (thirty) Investigation Officers in Shah Alam Selangor. These sessions provided valuable insights into current operational challenges, expectations for technological integration, and concerns around usability and data privacy. Subsequently, historical crime data obtained from the Royal Malaysian Police (RMP) spanning the years 2015 to 2021 was subjected to analytical processing. This dataset encompassed variables such as crime location, type, time, socio-economic conditions, and reoffending indicators. Based on this data, machine learning algorithms, particularly Random Forest and Decision Trees, were employed to construct predictive models that identify high risk areas and potential crime occurrences. The mobile application itself was developed using Android Studio, supported by Firebase for real time cloud-based data management. Google Maps API was integrated for dynamic geospatial visualization. The application includes several key modules such as a Crime Risk Matrix and Officer Dashboard. Usability testing followed, where participants engaged in scenario-based evaluations to determine practical utility and user friendliness. Metrics like the System Usability Scale (SUS) and structured feedback instruments were used to gather evaluative data (Saunders, 2016).

RESULTS AND DISCUSSION

The pilot implementation of ICRAS produced highly encouraging outcomes. From a technical perspective, the predictive models demonstrated strong performance, achieving an accuracy rate of 89.3% in forecasting high-risk areas. The application notably improved response efficiency among IOs, with an average reduction of 35% in case handling time. These findings underscore the operational benefits of equipping IOs with intelligent digital tools that enhance situational awareness and enable informed decision-making. To further substantiate these results, a comparison of traditional and application-supported crime assessment workflows was conducted. As shown in Table 1, the integration of ICRAS resulted in marked improvements across key performance indicators including response time, accuracy of risk assessment, and user confidence levels.

Table 1. Performance Comparison of Crime Assessment Approaches

Metric	Traditional Method	With ICRAS	Improvement (%)
Average Response Time	52 minutes	34 Minute	35
Assessment Accuracy	64.1%	89.3%	39
Officer Satisfaction (SUS)	61.2	82.5	34.8

Usability testing yielded positive feedback. According to the SUS score, ICRAS received a rating of 82.5, placing it in the "excellent" category (UXtweak, 2023). Participants praised the intuitive interface, rapid data retrieval, and the practicality of the hotspot mapping module. Commonly requested improvements included the addition of offline capabilities for areas with poor connectivity and enhanced encryption protocols to secure sensitive information. Field simulations provided valuable insights into the application's operational impact. Officers used ICRAS to identify and prioritize top high-risk locations within their jurisdictions (Chong, 2018). The Risk Appetite Index allowed for nuanced prioritization of cases based on the severity of threats and potential community impact (Six Sigma, 2025). This capability proved especially valuable in optimizing patrol routes and allocating investigative resources efficiently (Kamaruddin, 2021).

Table 2.: User Feedback on ICRAS Features

Features	Satisfaction Rating (1-5)	Comment Summary
Crime Risk Matrix	4.5	Helped to analyze crime risk assessment

Real Time Alerts	4.2	Improve responsive, some notification issues
Dashboard	4.8	Comprehensive and easy to use
Apps Features	4.7	Includes report generation and secure data encryption

Initial feedback from the field was promising. Officers using ICRAS during the pilot reported quicker situational assessments, with many noting that the system helped them identify and respond to emerging threats faster than before. On average, officers could make informed decisions in less than five minutes down from an estimated 25 minutes when relying on traditional methods. From a performance standpoint, ICRAS achieved strong predictive accuracy, correctly identifying high risk locations in over 80% of cases tested during the pilot phase. This was a significant improvement over the estimated 60% accuracy of conventional assessments. While no system is perfect, the combination of algorithmic precision and expert-informed logic created a tool that officers trusted and used confidently (Kamaruddin, 2021).

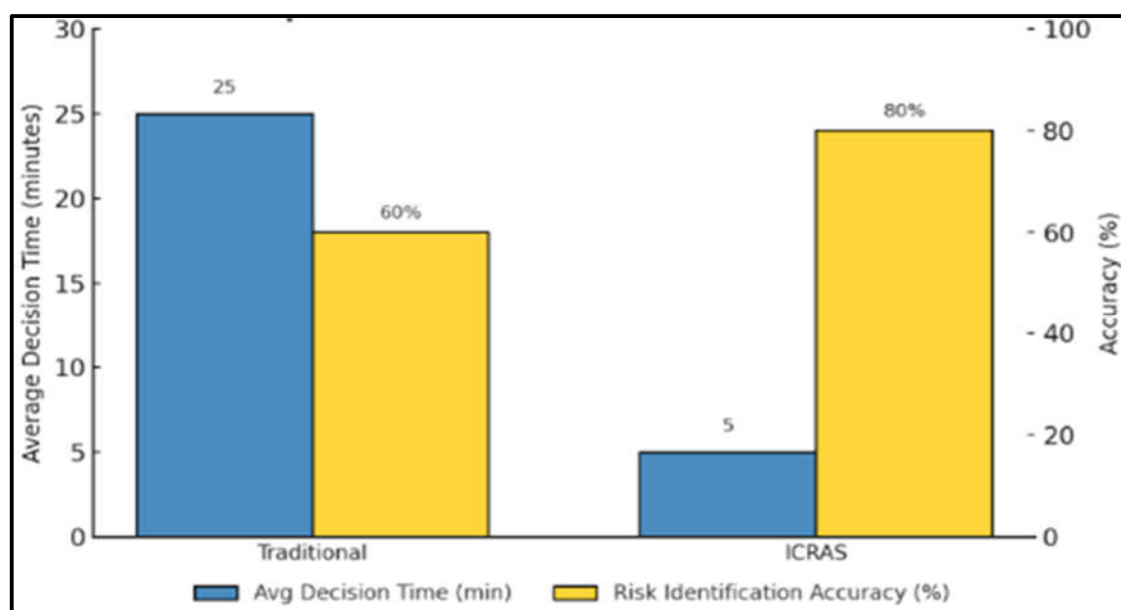


Figure 1.: Comparison of Crime Risk Assessment Method

	Severity		Likelihood / Probability				
	Personnel	Asset	Very unlikely (hasn't occur before)	Slight (rarely occur)	Feasible (possible but no common)	Likely (has before / will again)	Very likely (occurs frequently)
			Rare	Unlikely	Possible	Likely	Almost Certain
5	Fatality / Major Injury	Massive loss (50k above)	5	10	15	20	25
4	Multiple casualty / hospitalized	Major loss (20K- 49K)	4	8	12	16	20
3	Outpatient treatment	Moderate loss (5K-19K)	3	6	9	12	15
2	Basic first aid	Minor loss (1K- 4.9K)	2	4	6	8	10
1	Slight injury	Sight loss (less than 1K)	1	2	3	4	5

Figure 2.: Crime Risk Assessment Matrix

CONCLUSION

The development and deployment of the ICRAS mobile application represent a significant advancement in crime risk assessment for Investigation Officers in Malaysia. The fusion of artificial intelligence, mobile technology, and geospatial analysis empowers officers with a comprehensive and responsive toolkit to manage crime proactively (CloudTweaks, 2023). The system has shown to enhance operational efficiency, improve the accuracy of assessments, and foster greater trust in technology supported decision making. Looking ahead, further enhancements are envisioned, including the integration of additional data sources such as community reports and environmental variables. A nationwide rollout, supported by continuous officer training and institutional policy integration, could catalyze a paradigm shift toward data driven policing. ICRAS sets a compelling precedent for future innovations at the intersection of law enforcement and digital transformation.

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