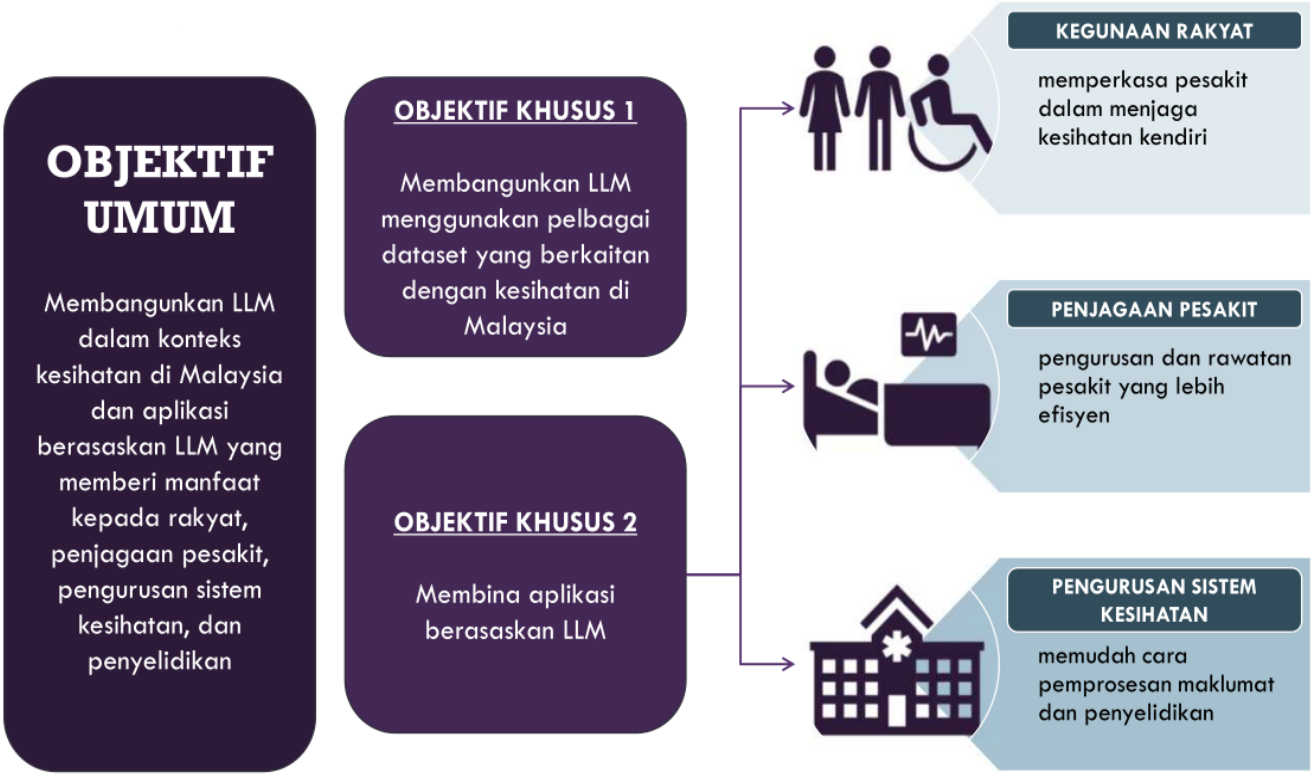
STRATEGIC RESEARCH FUND:

REQUEST FOR PROPOSAL (SRF-RFP)

TITLE	**DEVELOPMENT OF LARGE LANGUAGE MODEL (LLM) IN THE HEALTH SECTOR FOR MINISTRY OF HEALTH (MOH) APPLICATION:** **Transforming Healthcare Guided by Artificial Intelligence (AI)**
PROBLEM STATEMENT	The government continuously strives to improve the healthcare services provided to the public to be more efficient and effective. Identified challenges include: 1) The **complexity of self-health management** due to the abundance of information online. 2) The **operational complexity** in daily healthcare service delivery as demands increase, and 3) The **complexity** in making **strategic decisions** due to diverse data and information systems from multiple sources. AI technology, such as Large Language Models (LLMs), is seen to transform Malaysia's healthcare sector by empowering public health through more efficient management of healthcare systems and the delivery of healthcare services.

OBJECTIVES	**General Objective:** To develop an LLM in the context of Malaysia's healthcare and LLM-based applications that benefit the public, patient care, health system management, and research.



Specific Objectives

1) To develop an LLM using various Ministry of Health (MOH) datasets related to health in Malaysia. Beyond LLM, the potential use of Small Language Models (SLM) may also be considered as an option for developing clinical models for MOH.

2) To build LLM or SLM-based applications in areas such as:

<table>
<tr><td></td><td>a) Public Use: Empowering patients in self-care.
Example: building a Question-Answering Chatbot on the MOH website or within Personal Health Record (PHR) systems to find medical information.

b) Patient Care: More efficient patient management and treatment.
Example: building automated text generation to produce discharge summaries and referral letters.

c) Health system management and research: Facilitating information processing and research by identifying patients based on research criteria.
Example: building medical auto-coding for diagnosis and procedure data by medical record officers.</td></tr>
<tr><td>AI POLICY IMPLEMENTATION</td><td>1. Data and Information Usage<table><tr><td>Localized Datasets</td><td>● To incorporate Bahasa Melayu corpora, considering its status as the national language and its cultural and demographic significance within Malaysia’s diverse multicultural society.</td></tr></table></td></tr>
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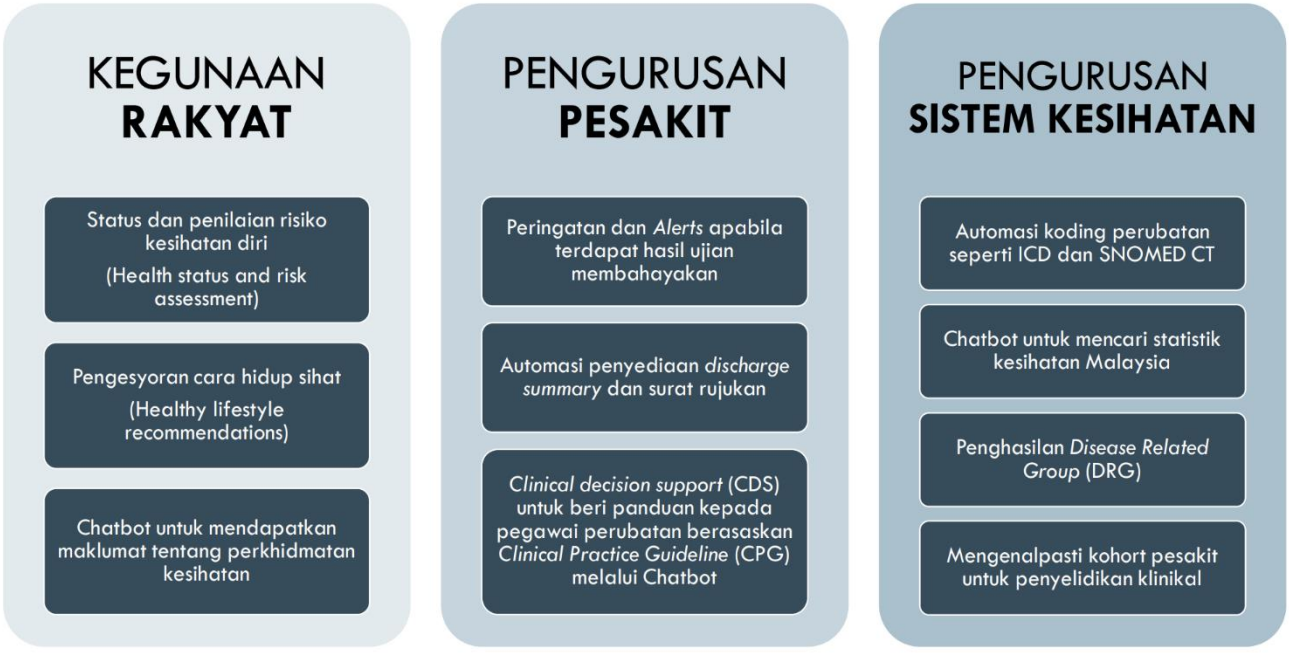
		● The use of contextually relevant local datasets in model training is emphasized, especially for applications in the public sector and healthcare domains.
	Encryption and Tokenization	● The protection of personally identifiable information (PII) through tokenization or masking is a critical step before data is used for analytics or AI model training. ● To ensure privacy and compliance, public sector data must undergo anonymization or pseudonymization before being shared for the purpose of AI model training.
	Personal Data Protection Act (PDPA)	● To ensure compliance with Malaysia's data privacy laws, personal data must be properly managed, safeguarded and protected throughout its use in AI or analytics processes.

	2. **Local Talent and Technology Adoption**	
	AI Sandbox	● Develop a common and reusable AI sandbox with regulatory compliance. ● A cost-effective AI sandbox designed by local talent to support a wide range of industries, including healthcare, education, agriculture, and more. ● Leverage local companies with homegrown technologies to implement AI solutions that are skilled and expert in the respective industry. ● Offloading expensive High Bandwidth Memory (HBM) and Graphics Double Data Rate (GDDR) memory to cost-effective flash memory. Eliminates the need for large numbers of high-cost and power-hungry GPU cards during AI model training.
	Private and Public Cloud	● A private cloud should be utilized for AI model development and training, given that it's an iterative

		process requiring secure handling of protected and sensitive datasets throughout its lifecycle. ● Support the adoption of cloud-based AI, federated learning and edge AI compute for AI applications roll out based on the baseline model releases. ● To support Malaysia's Cloud First Policy (MyGovCloud), enabling AI-as-a-Service.
	Explainable and Responsible AI	● All AI solutions shall comply and support Explainability (XAI), Auditability and Traceability. ● Proposed register for certified AI solutions (MySTI) for safe deployment. ● Model could be used and shared with public and private sectors, eventually with open-source communities in the future.

	3. Data and Information Security	
	Data-in-Use	● PII data protection through data pseudonymization, tokenization, encryption, etc. ● Role-based access control (RBAC) for data query and access. ● Automated backup with version control.
	Data-in-Transit	● All communication among systems must be secured using TLS, HTTPS, VPN, etc. ● API calls must be secured and authenticated such as using OAuth2, signed tokens (end-points security), etc.
	Data-at-Rest	● Must use strong encryption (AES-256+) for data storage. ● Automated backup with version control.
	Classification and Audit Log	● All public sector datasets must be classified (such as confidential, restricted, public, etc.) and access must be logged and audited regularly.

EXPECTED PROJECT OUTCOMES (USE CASES)	1) A centralized, secure, updatable **Clinical LLM (CLLM) tailored for Malaysian healthcare**, serving as a language model repository for future AI projects. 2) **Applications for the public**, such as mobile apps showing personal health status, risk assessments, healthy lifestyle recommendations, and health service chatbots. 3) Applications for **patient management**, like alerts for critical lab results, automated generation of discharge summaries and referral letters, and clinical decision support tools tied to Clinical Practice Guidelines (CPG) through QA chatbots. 4) Applications for **health system management**, like automating medical coding (ICD, SNOMED CT), producing DRGs, identifying cohorts for research, and using QA chatbots for health statistics.



JUSTIFICATIONS	1) Supporting the National Artificial Intelligence Roadmap 2021-2025 with a focus on healthcare. 2) Supporting the Health White Paper for the transformation of Malaysia's healthcare system through the empowerment of digitalization in the health sector. 3) Establishes a foundation for AI health technology that: a) Makes health services and information more accessible to the public. b) Empowers personalized self-health guidance. c) Enhances clinical decision-making and daily process efficiency. d) Strengthens data-driven health system management and research, supporting strategic agency decisions. e) Prepares national data processing capacity for future health financing transformations.
METRICS SPECIFICATION AND SCOPE OF WORKS	The project aims to develop a high-context, compliant Clinical LLM. Outcomes include improved diagnostic support and data analysis. Benchmarks will include accuracy, relevance, privacy compliance, with measurements covering accuracy, recall, score, latency, and user satisfaction through clinical validation and real-world pilot testing.

	1) KKM Clinical LLM (CLLM) a) Identifying, collecting, and processing various datasets related to health within the Ministry of Health (MOH). This processing includes ensuring the anonymization of patient or user identities in the datasets to be used; b) Preparing and returning the processed datasets (training datasets) for future use by the MOH; c) Providing the hosting services, hardware, and software required for the development and deployment of scalable LLMs; d) Training scalable, efficient LLM models that are suited to the context of healthcare in Malaysia; e) Testing the model's performance to ensure the effectiveness and accuracy of the outcomes produced; f) Ensuring the model complies with responsible AI guidelines and principles, including data privacy, transparency, and fairness; and g) Improving the model from time to time according to needs and technological advancements.

	2) LLM-based MOH Applications: a) Designing and developing use-case applications based on the mutually agreed LLM; b) Providing the infrastructure and hosting services, hardware, and software required for the development of LLM applications; c) Testing the applications in various situations/scenarios to ensure their reliability and safety for use; d) Deploying the applications to users and providing training to the relevant staff; e) Ensuring the applications comply with health informatics standards such as ICD, SNOMED CT, LOINC, and MyHDW; f) Ensuring the security aspects of the developed applications adhere to relevant guidelines, circulars, and ISO standards; g) Ensuring the developed applications integrate with existing systems within the MOH; and h) Maintaining and enhancing the applications according to needs and technological and methodological advancements.
TIMELINE	The project development is divided into three main phases;

	Each development phase is recommended to use system development solutions available within MySTI (for example: AIDevX developed by MIMOS). **Phase 1: LLM Development** [9 months] • Collection and processing of data, merging and preparing data, including ensuring the anonymization of sensitive patient information; • Selection of suitable pre-trained models as a foundation for training scalable and efficient LLMs tailored to the context of healthcare in Malaysia; and • Testing the performance of the LLM and fine-tuning parameters according to the needs of MOH applications. **Phase 2: Application Development** [12 months] • Designing, developing, implementing, and testing LLM-based applications; • Deploying LLM-based applications at the user level; and • Integrating them with existing information systems within the MOH. **Phase 3: Pilot & Training** [12 months] • Conducting pilot implementation to evaluate application performance; • Evaluating the LLM and applications based on user satisfaction;

	• Fine-tuning the LLM based on user feedback; and • Transferring technology and providing skills and knowledge development training.	
MAXIMUM FUND VALUE (RM)	Estimated at **RM 15 million**.	
TECHNOLOGY READINESS LEVEL (TRL)	The project must be at a minimum of TRL 3 (at the time of application) and reach TRL 7 and above (at the end of the funding/project period).	
REFERENCE	Pusat Informatik Kesihatan, Bahagian Perancangan, Kementerian Kesihatan Malaysia (KKM)	
POTENTIAL STAKEHOLDERS	1) Ministry of Science, Technology and Innovation (MOSTI) 2) Ministry of Health Malaysia (MOH) 3) Ministry of Communications (KKOM) 4) Ministry of Digital (KD) 5) National Digital Department (JDN)	
APPLICATION PROCESS	**Submission**	Via *Sistem Dana Bersepadu* MOSTI at SDB: SRF-RFP
	Duration	**33 months** total for three phases Phase 1: **9 months** Phase 2: **12 months** Phase 3: **12 months**
	Application Guidelines	Full requirements details are in the SRF-RFP Guidelines at GP SRF-RFP