SingHealth

Defining Tomorrow's Medicine

Artificial Intelligence Project Pitch

Presented by Group 02

Overview

INTRODUCTION

SINGHEALTH'S BACKGROUND

- Largest healthcare group in Singapore since 1998
- Operations across public hospitals, community hospitals, specialty centers, and polyclinics

SingHealth
Defining Tomorrow's Medicine

Singapore General Hospital
Changi General Hospital
Sengkang General Hospital
KK Women's and Children's Hospital
National Cancer Centre Singapore
National Dental Centre Singapore
National Heart Centre Singapore
National Neuroscience Institute
Singapore National Eye Centre
SingHealth Community Hospitals
Polyclinics SingHealth

SINGHEALTH'S VISION

- Continuous Modernization and Community Health Enhancement
- Emphasis on Digitizing Patient Records and Integrating AI

CYBER INCIDENTS IN 2018

- Negative Impact on SingHealth's Reputation

SWOT ANALYSIS

STRENGTHS

- Reputation
- Robust Infrastructure
- Skilled workforce
- Research and Innovation

WEAKNESSES

- Reliance on Government Funding
- Limited human capability in assessing and responding to risks.
- No Proper Network Security Team

OPPORTUNITIES

- Technological Advancement
- International Collaboration

THREATS

- Regulatory Changes
- Cybersecurity Risks
- Competitors

PESTLE

POLITICAL

- Huge Support and Control from Government Policies
- Political Stability

ECONOMIC

- Healthcare Expenditure
- Economic Growth

SOCIAL

- High Community Awareness of Personal Information
- High AI Readiness in Government, Business, and Consumers (Salesforce 2021).

TECHNOLOGY

- Technology Advancement
- Data Management and Privacy

LEGAL

- Resource consumption (hardware, software, etc.)

ENVIRONMENTAL

- National Healthcare Regulations (HIPAA;...)
- Intellectual Property Protection (Förster n.d.)
- Domestics Regulations (PDPA)

Problem Statement

- “Data privacy” is no longer a nice-to-have but turned into “data security” - a must.
- Cyber attacks cost SingHealth $4 million and damaged reputation.
- SingHealth weaknesses cannot be addressed with human efforts ==> require the assistance of automated machine.

Related AI Solution

- **CyberAI based on ML and NLP technology**

Current AI applications

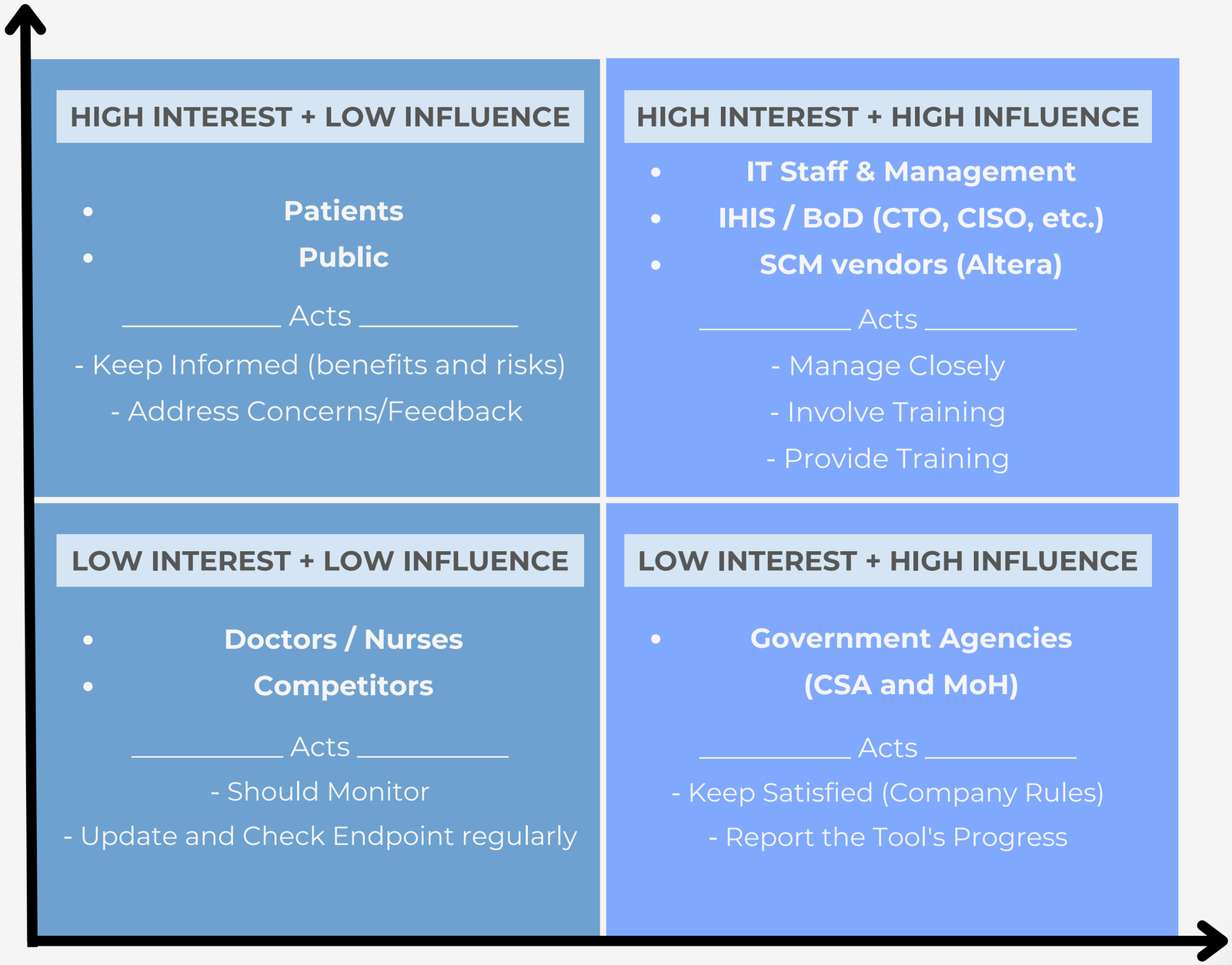
Doctor Covid

A chatbot to translate medical conversations.
Technology: NLP, ML

SELENA+

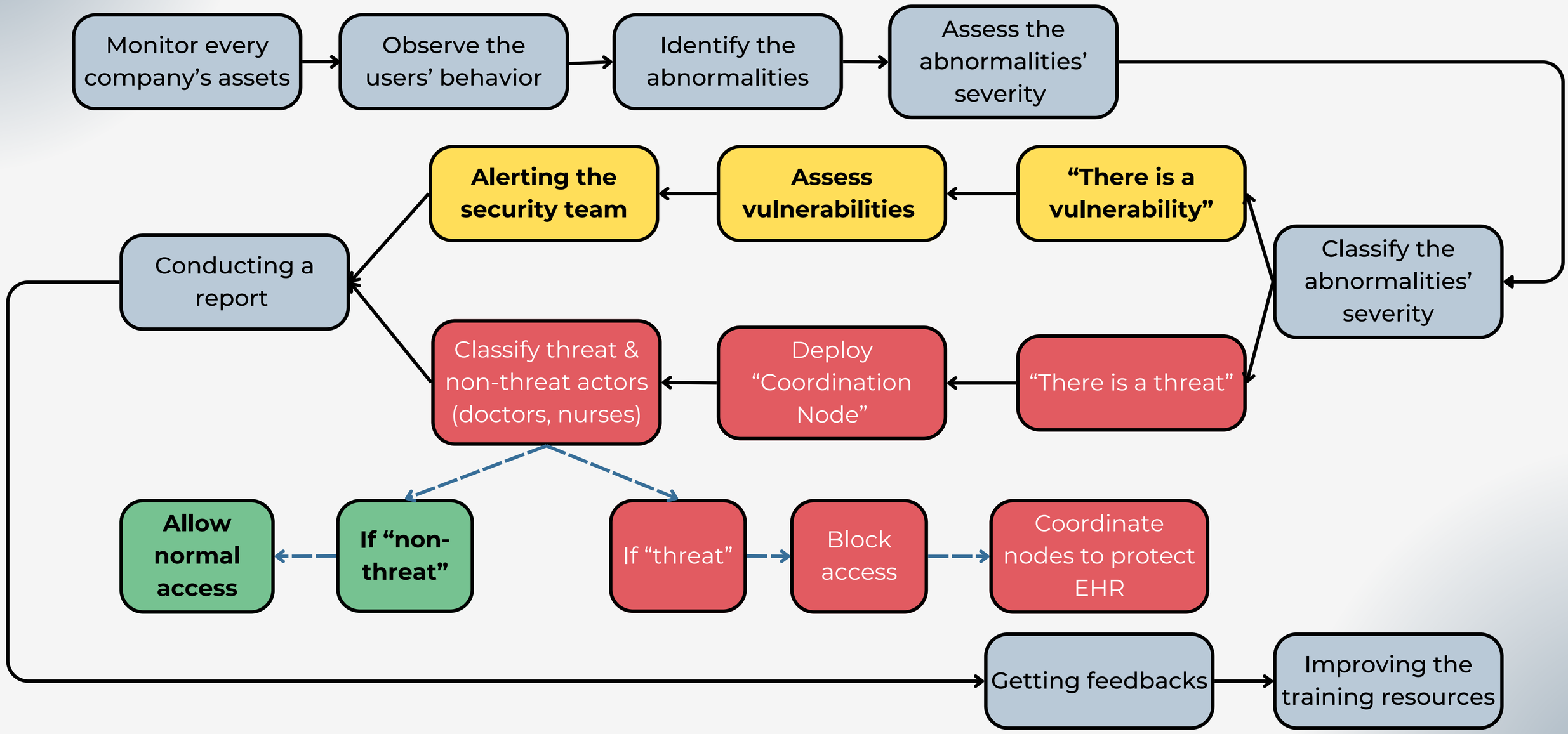
Singapore Eye Lesion Analyser, image reader that can analyse eye scan for detecting diabetes.
Technology: NLP, ML

Stakeholders Analysis



AI Strategy for CyberAI

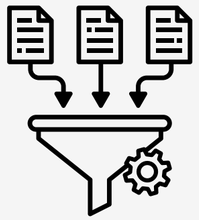
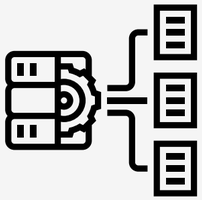
AI step-by-step process



Data strategy

	Data Category	Collecting Methods	Processing Methods	
	**The System, Network, Endpoints Behavior**	SIEM system EDR, IDS/ IPS (Vectra n.d.)	Unsupervised Machine Learning	
	**Upcoming threats**	Cybersecurity reports Hackers' forum	Predictive Analysis	NLP
	**Users' Behavior**	Cookies (Marr 2017)		Behavioural Analysis
	**Common threat characteristics**	IDS/ IPS		Supervised ML
	**Authorized accounts access list**	SIEM system	Supervised Machine Learning	

Architecture

Layers of big data	Infrastructures (Tools/Services/Technology)
 Data collection	• SIEM system (ManageEngine Log360) • EDR agent (Cisco AMP) • IDS/IPS (Cisco Secure IPS) • Cookies
 Data storage	The Sunrise Clinical Management (SCM)
 Data analysis and processing	TensorFlow
 Providing access to data	Citrix Virtual Application

AMP for Endpoints

ManageEngine Log360

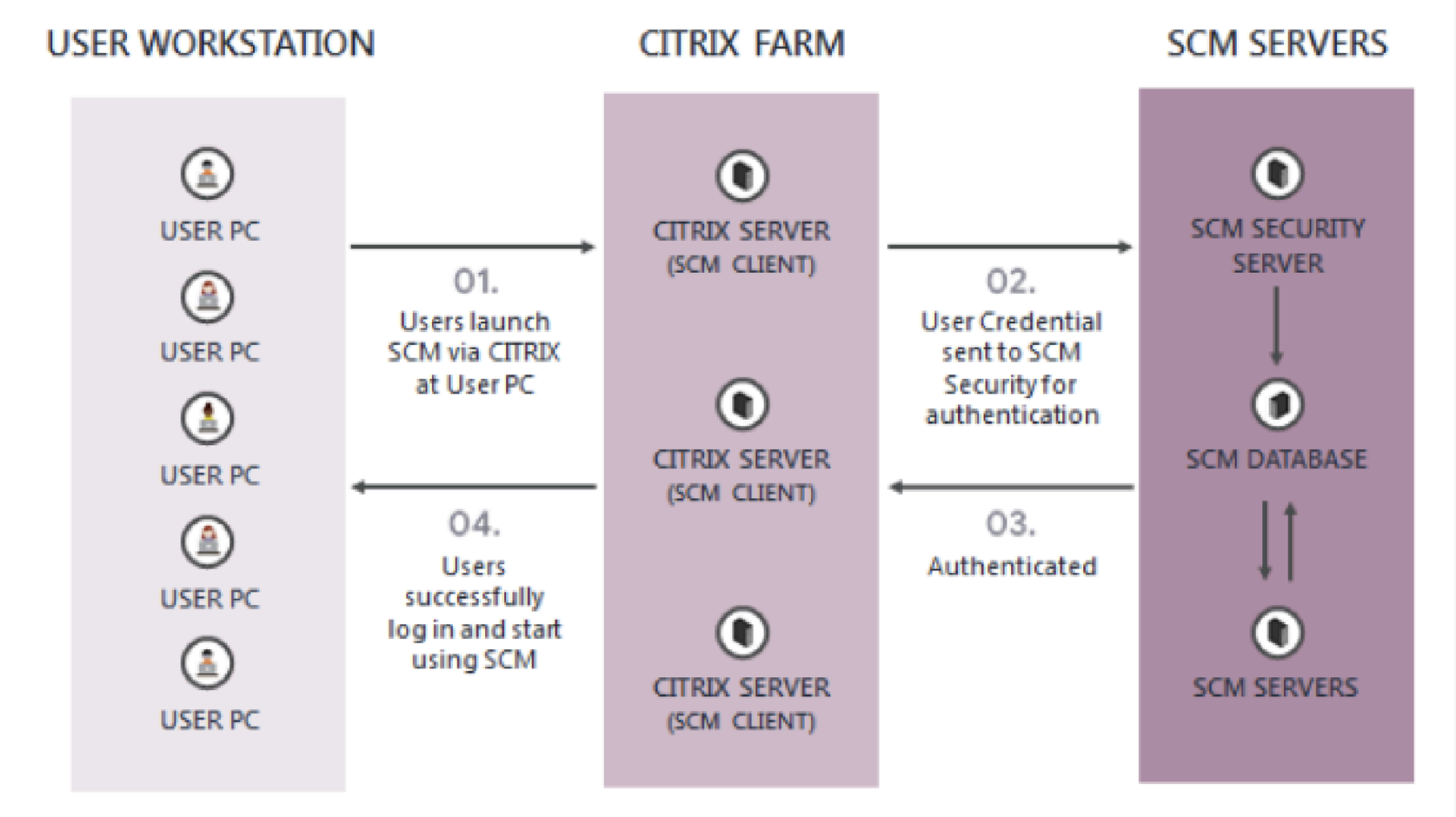
CISCO

SUNRISE HEALTHCARE MANAGEMENT

TensorFlow 2.0

citrix™

“Data Storage” - “Providing access to data” Layers



Source: COI (2019)

Data Transmission

ABOUT HEALTHCARE CLOUD (H-CLOUD)

Healthcare Cloud (H-Cloud) is a consolidated, cloud computing platform supporting healthcare staff at all public hospitals, eight specialty centres, polyclinics and nursing homes, to retrieve and access patient records.

H-Cloud is the public healthcare's first private cloud setup that reduces operational costs and improves infrastructure availability to 99.95%.

H-Cloud is ISO 20000-1 (Information Technology Service Management) and 27001 (Information Security Management System) certified. These international certifications help to assure all stakeholders that H-Cloud processes follow industry best practices

Enhanced operational efficiency and higher resiliency

Cost savings for healthcare institutions and patients

Well-equipped to defend and detect cybersecurity threats

Source: Synapxe (n.d.)

Organizational capabilities

Strengths

- Fully Digitized Dataset
- Strong Research Culture
- Hospital Budget

Weaknesses

- IT Staff Mindset
- Cybersecurity Expertise of Senior Management level

Change Management

Ensure buy-in from all stakeholders	Effectively communicating the benefits of AI brings to cyber security, such as enhanced threat detection and mitigation
Delineation of responsibilities	Clearly defining which are tasked with AI model training, system integration, and ongoing AI maintenance
Training programs for appropriate employees	Ensuring that all employees understand how to effectively use the AI system
Long-term strategic planning of AI solutions	Regular system updates, SingHealth must provide ongoing training opportunities for staff

BUSINESS MODEL CANVAS

KEY ACTIVITIES

- Empathise SingHealth problems and develop a customized AI software solution.
- Help deploy the software integrated with SingHealth's current system.
- Train security staff to adapt to the new software.
- Maintenance and keep the software up-to-date.

KEY PARTNERS

- Government agencies - must comply with and receive support from.
- Vendors/ Suppliers of high-quality software/hardware.

KEY RESOURCES

AI Platform powered by data on phishing behaviour collected by Google

VALUE PROPOSITION

An AI-based solution that transforms the way SingHealth stores and protects customers' data.

CUSTOMER RELATIONSHIP

Offer 60-day free trial for an MVP.

CHANNELS

- **AI Platform:** TensorFlow.
- **Cloud:** H-cloud.

CUSTOMER SEGMENT

Business-to-business: Hospitals.

- **Firmographics:** located in Eastern Singapore, leading the Eastern network of healthcare.
- **Technographic:** highly digitalized, operate collaboratively in a cloud-based suite.
- **Needs-based:** quality-focused segment.
- **Sophistication-based:** never used AI for security before.

COST STRUCTURE

- **Fixed costs:** Proof-of-Concept, Infrastructure, Cloud server, Professionals.
- **Variable costs:** Extra cloud storage if data increases.

REVENUE STREAMS

- **Software sales**
- **Support and Care** service, including deployment and frequent maintenance.

FINANCIAL PLAN

COST STRUCTURES

Tasks	Tools/ Infrastructure	Price ($/month)
Data collecting	IDS/IPS (Cisco Secured IDS)	$3,000
	SIEM (Log360)	$200
	EDR (Cisco AMP)	$1,680
Data storage	EHR database by SCM	$1,000
	H-cloud	$1,500
Data analysis and processing	TensorFlow	$0.00
Providing access to data	Citrix	$7,000
Team salary	_ 4 Developers _ 1 Business Analyst _ 1 Project Manager	$8,000
Total		**$25,380**

REVENUE STREAMS

Total cost to develop the full application

$913,680

Price per a unit (exclude other services):

$70,000

To achieve break-even:

13 packages

Estimate time till break-even:

> 6 months

Concerns

Legal responsibility and accountability

- Designating who is responsible for the actions of AI systems, ensuring that protocols are in place.
- Involves an individual or group developing a comprehensive set of terms and conditions.
- Ex: If the AI erroneously predicts a cyber attack, the AI provider will be held accountable

Incident response and reporting

- Building and maintaining an effective and timely incident response plan for all security breaches.
- Ensuring compliance with Singapore's data protection laws.

Government regulations and guidelines

- Clear procedures for reporting breaches to authorities and affected individuals. Ensuring compliance with Singapore's data protection laws.
- Monitoring regulatory developments, participating in industry discussions, and seeking legal advice

Concerns

Accuracy

Detection rate ***95%***

Potential **false positive** rate of around ***4-5%***

Involvement of expertise and security personnel to monitor AI development

Thank You For Your Attention

REFERENCE

Alder S (2023) Editorial: Why Do Criminals Target Medical Records, HIPAA Journal website, accessed 23 January 2024. https://www.hipaajournal.com/why-do-criminals-target-medical-records/

Amos Z (2023) AI Is Crucial for Healthcare Cybersecurity, Unite.AI website, accessed 23 January 2024, https://www.unite.ai/ai-is-crucial-for-healthcare-cybersecurity/

Ang A (2022) SingHealth extends Sunrise contract with Altera Digital Health for interoperability, Healthcare IT News website, accessed 22 January 2024. https://www.healthcareitnews.com/news/asia/singhealth-extends-sunrise-contract-altera-digital-health-interoperability

Armerding T (2018) SingHealth hit with ‘unprecedented’ cyber attack, Synopsys website, accessed 23 January 2024. https://www.synopsys.com/blogs/software-security/singhealth-cyber-attack.html

Chong C (2021) S’pore’s health science innovations get AI boost in SingHealth, SGInnovate tie-up. The Straits Times. https://www.straitstimes.com/singapore/spores-health-science-innovations-get-boost-from-artificial-intelligence-in-singhealth. Accessed 24 Jan 2024.

Committee of Inquiry (2019) Public Report of the Committee of Inquiry into the cyber attack on Singapore Health Services Private Limited's Patient Database on or around 27 June 2018, Government Technology Agency, Singapore Government, accessed 22 January 2024. https://file.go.gov.sg/singhealthcoi.pdf

REFERENCE

Corrigan CC (2022) Lessons learned from co-governance approaches–Developing effective AI policy in Europe. In The 2021 Yearbook of the Digital Ethics Lab (pp. 25-46). Cham: Springer International Publishing, accessed 22 January 2024.

Darktrace (n.d.a) Protecting Hospitals From Ransomware, accessed 26 January 2024. https://darktrace.com/resources/protecting-hospitals-from-ransomware

Darktrace (n.d.b) Darktrace AI: Combining Supervised and Unsupervised Machine Learning, Darktrace website, accessed 24 January 2024. https://darktrace.com/resources/darktrace-ai-combining-supervised-and-unsupervised-machine-learning

Dekker N (2022) *33 Emerging Artificial Intelligence Statistics*, eftsure website, accessed 26 January 2024. https://eftsure.com/statistics/artificial-intelligence-statistics/#source-wrapper

Doshi-Velez F, Kortz M, Budish R, Bavitz C, Gershman S, O'Brien D, Scott K, Schieber S, Waldo J, Weinberger D and Weller A (2017) Accountability of AI under the law: The role of explanation. *arXiv preprint arXiv:1711.01134*, accessed 23 January 2024.

Exabeam (n.d.) *Threat Detection and Response: Technologies and Best Practices*, Exabeam website, accessed 24 January 2024. https://www.exabeam.com/explainers/next-gen-siem/threat-detection-and-response-technologies-and-best-practices/

Förster M (n.d.) *Intellectual Property Protection*, ASEAN Briefing website, accessed 25 January 2024. https://www.aseanbriefing.com/doing-business-guide/singapore/company-establishment/intellectual-property-protection

REFERENCE

Frontegg (2022) *What Is Attribute-Based Access Control (ABAC)?,* Frontegg website, accessed 24 January 2024. https://frontegg.com/guides/abac

Habbal A, Ali MK and Abuzaraida MA (2024) Artificial Intelligence Trust, Risk and Security Management (AI TRiSM): Frameworks, applications, challenges and future research directions. *Expert Systems with Applications*, *240*, p.122442, accessed 23 January 2024.

IBM (n.d.a) Artificial Intelligence (AI) Cybersecurity, IBM website, accessed 23 January 2024. https://www.ibm.com/ai-cybersecurity

Kar A, Wreesmann VB, Shwetha V, Thakur S, Rao VU., Arakeri G and Brennan PA (2020) Improvement of oral cancer screening quality and reach: The promise of artificial intelligence. Journal of Oral Pathology & Medicine, 49(8), pp.727-730, accessed 23 January 2024.

Keary T (27 February 2024) The Best SIEM Tools for 2024: Vendors & Solutions Ranked, Comparitech website, accessed 26 January 2024. https://www.comparitech.com/net-admin/siem-tools/

Knowledge Bank (n.d) Singapore's Journey to Build a National Electronic Health Record System, Hospital & Healthcare Management website, accessed 23 January 2024.

Koh D (2020) *CGH & IHiS develop AI tool to predict severity of pneumonia in patients*, Healthcare IT News website, accessed 22 January 2024. https://www.healthcareitnews.com/news/asia/cgh-ihis-develop-ai-tool-predict-severity-pneumonia-patients