

# The Ardú Project

## Research Document

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Institiúid Teicneolaíochta Cheatharlach



INSTITUTE *of*  
TECHNOLOGY  

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# Abstract

*The purpose of this document is to provide a written account of the research conducted over the course of the project. The following document details a number of systems and technologies grouped into their respective categories for comparative purposes.*

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# 1 Introduction

The following document will provide a detailed review of the research conducted over the course of the project and will be further extended with any additional research.

As the project is implementing an agile, iterative approach....

The document will provide a background on the following categories of technology:

- Encryption Software
- Web Frameworks
- Programming Languages
- Cloud Technologies

Also, this document will also discuss research conducted into similar applications or applications of the same nature of sensitive information.

## **2 Existing Clinical Management Systems**

This section of my research will be in regard to existing systems that have previously been implemented and made available to customers. My interest in researching these systems will be

identifying requirements, unique factors this system may include, the UI screens, technologies used, the creator/s of the/these system/s and where it is used.

## 2.1 CMS 3X

CMS 3X is a popular open-source Clinical Management System developed by Mobigator Technology Group which develop solutions in Healthcare, Insurance, Finance and Telecom across the UK, US and Asia. [1] The CMS 3X application is implemented by The Hong Kong Medical Association (HKMA) and Information and Software Industry Association (ISIA) - screenshots and support & help can be found hosted by The Hong Kong Medical Association website. [2]

### 2.1.1 User/Admin CMS 3X GUI

#### 2.1.1.1 Login Page

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Username:

Password:

The CMS3X is an open-source clinic management system project jointly implemented by the Hong Kong Medical Association (HKMA) and the Information and software Industry Association (ISIA), with the funding support from the Office of the Government Chief Information Officer (OGCIO) under the Sector-specific Programme (SSP) for the Medical and Health Sector, and was developed by the Mobigator Technology Group.

## 2.1.1.2 Main Page

Copyright © CMS 3XI - GPL 2.0

Version 1.0.10937

## 2.1.1.3 Patient Record

Copyright © CMS 3XI - GPL 2.0

## 2.1.1.4 Appointment

## 2.1.1.5 Waiting Queue

Patient No.	Patient	Chinese Name	Sex	Age	Arrived at	Appointment	Status	Remarks
1	VEGA Ingrid	甄平韻	M	33y	03:23 pm		Waiting	
2	SHAW Erica	吳欣潔	M	81y	03:23 pm		Waiting	
3	JOHNSTON Jeremy	李景翔	M	40y	03:23 pm		Waiting	
4	ATKINSON Lee	吳俊傑	M	33y	03:24 pm		Waiting	
5	LEE Alisa	陳桂嫻	M	54y	03:24 pm		Waiting	

Cancel Add to Waiting Queue Assign to Another Doctor Take Vitals Consultation

Version 1.0.10937

## 2.1.1.6 Consultation

LEE Alisa 陳枝蕊 (M54y) | 100285
Encounter Type: Consultation

Save as Template
Select a consultation template
Copy from Previous

**Consultation Note**  
 No Vital Sign Data!  
**Symptom:**  
 Pt. states that she has always been overweight. She is very frustrated with trying to diet.  
**Assessment:**  
 Obese at 183% IBW, hypercholesterolemia  
**Diagnosis:**

Diagnosis	Description
006	Amebiasis

**Observation:**  
 WT = 210 lbs HT = 60 BW = 115 lbs Chol = 255 BP = 120/75  
**Plan:**  
 Long Term Goal: Change lifestyle habits to lose at least 70.

**Medical Background**  
 Blood Type: B  
 G6PD Status: Please select...  
 Smoking History: Normal Smoker  
 Drug Allergies:  
 Priton

**Prescription**  
Save Print Reset Select a prescription template Copy from Previous Label language

Item	Q/T	Unit	T/D	Days	Qty	Instruction	Advisory	Remark	Unit Pri	Amt
Priton	3	tablet	3	3	27	Before sleep	Do not stop		\$10.00	\$270.00
Ancillin Capsules	3	tablet	3	3	27	Before sleep	Do not stop		\$30.00	\$810.00
Unasyn Tablets	3	tablet	3	3	27	Before sleep	Do not stop		\$20.00	\$540.00
Total (\$)										\$1,620.00

**Billing**  
Save as Template Select a billing template Copy from Previous

Item	Standard (\$)	Billed (\$)	Remarks
Consultation	\$400.00	\$400.00	
Blood Test	\$550.00	\$550.00	
	\$0.00	\$0.00	
Total (\$)		\$950.00	

**Problem List:**

Dx	Desc	Status
006	Amebiasis	Active
		0

Complete Consultation Hold Consultation Save Print Preview Cancel



## 2.1.1.7 Letter Editor (from Consultation form tab)

The screenshot shows the CMS Letter Editor interface. At the top, there is a navigation bar with tabs: WAITING QUEUE, APPOINTMENT, CONSULTATION (selected), DISPENSARY, INVENTORY, REPORT, CASH BOOK, ADMIN, and Patient Search. The patient information is displayed as LEE Alisa 陳枝盛 (M54y) | 100285, with Encounter Type: Consultation. The interface is divided into several sections:

- Left Panel (Saved Letters):** Shows a list of saved letters: Encounter 5 (2009-02-19), Sick Leave, and Other Letters.
- Top Action Bar:** Includes buttons for New, Save, Save As, Print, Send by Email, and Delete. The current template is Sick Leave (Dr. Alice Liu).
- Main Editor:** Features a rich text editor with a toolbar and a text area containing a "Certificate of Sickness" letter. The letter text is:

19th February, 2009  
To Whom It May Concern,  
This is to certify that LEE Alisa is suffering from  
  
is unfit for work and is recommended 1-day sick leave on 19th February, 2009.  
  
Regards,  
Dr. Alice Liu
- Right Panel (Medical Background):** Contains fields for Blood Type (B), G6PD Status (Please select...), Smoking History (Normal Smoker), and Drug Allergies (PRtOn). There is also a Remarks field.
- Bottom Panel (Problem List):** A table with columns Dx, Desc, and Status.

Dx	Desc	Status
005	Amebiasis	Active
		0
- Bottom Navigation:** Buttons for Complete Consultation, Hold Consultation, Save, Print Preview, and Cancel. A Save button is also present in the bottom right corner.

### 2.1.1.8 Attachments (from Consultation form tab)

Medical Background

Blood Type: B

G6PD Status: Please select...

Smoking History: Normal Smoker

Drug Allergies:

PEton

Remarks:

Problem List:

Dx	Desc	Status
006	Amebiasis	Active
		0

### 2.1.1.9 Dispensary Queue

Dispensary

Patient No.	Patient	Chinese Name	Sex	Age	Arrived at	Appointment	Status	Remarks
1 100329	VEGA Ingrid	劉承綽	M	33y	03:23 pm		Dispensary	🔍
2 100393	SHAW Erica	吳欣誠	M	61y	03:23 pm		Dispensary	🔍
3 100403	JOHNSTON Jeremy	李景翔	M	40y	03:23 pm		Dispensary	🔍
4 100144	ATKINSON Lee	賈佐偉	M	33y	03:24 pm		Dispensary	🔍

🔍 Details

## 2.1.1.10 Dispensary & Payment

The screenshot shows a software interface for a dispensary. The main window is titled "Dispensary" and displays a list of patients. The patient "Vega Ingrid 劉承穎 (Male:33y) | 100329" is selected. The window shows a list of medications with columns for Item, Q/T, Unit, T/D, Days, Qty, Instruction, Advisory, Remark, Unit Price, and Amount. Below the list, there is a section for "Drug Allergy: No allergy record". The "Payment" section shows a "Total Amount: 1000.00" and a list of payment methods: Cash (\$500.00), Medical Card (\$500.00), and a Total Paid Amount of \$1,000.00, with an Outstanding Amount of \$0.00.

Item	Q/T	Unit	T/D	Days	Qty	Instruction	Advisory	Remark	Unit Pr	Amt
Piridon	3	tablet	3	3	27	Before sleep	Do not stop		\$10.00	\$270.00
Ancillin Capsules	3	tablet	3	3	27	Before sleep	Do not stop		\$30.00	\$810.00
Unasyn Tablets	3	tablet	3	3	27	Before sleep	Do not stop		\$20.00	\$540.00
Total (\$)										\$1,620.00

Payment Method	Remark	Amt
Cash		\$500.00
Medical Card		\$500.00
		\$0.00
Total Paid Amount(\$)		\$1,000.00
Outstanding Amount(\$)		\$0.00

## 2.1.1.11 Report Viewer

CMSS
WAITING QUEUE
APPOINTMENT
CONSULTATION
DISPENSARY
INVENTORY
REPORT
CASH BOOK
ADMIN

User: alice

**Reports**

- Billing
  - Total Revenue
  - Revenue by Insurer
  - Revenue by Medical Card Scheme
  - Income Report
- Prescription
  - Consumption
  - Drug Prescription
  - Dangerous Drug
- Inventory
  - Consultation History
  - Patient List
  - Diagnosis Alert Limits Report

**Patient List**

Patient No.	Name	Chinese Name	Sex	DOB (Age)	Mobile	Home
PN999999	CHAN Tai Man	陳太文	M	1945-02-28 (63y)	21234567	
PO000000	LEE Kam Shui	李金水	M	1973-05-01 (35y)	27654321	
PO000001	CHAN Siu Man	陳小文	M	1945-02-28 (63y)	21234567	
PO000003	LEE Tai Nik	李大力	M	1970-04-08 (38y)	23114444	
PO000004	WONG MeiLi	王美麗	F	1955-05-09 (53y)	23556411	
PO000005	SO Wai Wah	蘇偉華	M	1955-07-01 (53y)	32659988	
PO000006	AU Ka Kei	區家勁	M	1945-02-03 (64y)	98541236	
100000	BROCK Sharon	陳淑怡	M	1943-08-29 (65y)	485-212-9094	
100001	GRAY Davis	葛強琪	M	1940-08-26 (68y)	272-393-1095	
100002	HOLMAN Isaac	陳雪怡	M	1974-10-22 (34y)	114-421-8016	
100003	LOWERY Ori	廖峻傑	M	1998-11-07 (10y)	963-815-1946	
100004	HOUSE MacKenzie	林焯熾	M	1989-02-03 (20y)	935-639-0771	
100005	QUINN Tyler	黃國豐	M	1968-11-30 (40y)	331-885-1648	
100006	CRAFT Cairo	吳則倫	M	1991-07-03 (17y)	042-200-8077	
100007	WALTERS Jaime	郭宏儀	M	1954-11-02 (54y)	018-231-5780	
100008	WISE Zachery	張家銘	M	1948-02-02 (61y)	280-474-2840	
100009	PRICE Tiger	張強康	M	1962-11-28 (46y)	694-296-5842	
100010	FULLER Anne	黃國香	M	1998-01-09 (11y)	308-237-0161	
100011	GUY Dana	樊家瑜	M	1942-01-04 (67y)	396-468-7292	
100012	RIGGS Ferdinand	蔡柏壽	M	1987-11-19 (21y)	390-670-4244	

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## 2.1.1.12 Administrator Interface

The screenshot displays the CMS 2.x Administrator Interface. The top navigation bar includes tabs for WAITING QUEUE, APPOINTMENT, CONSULTATION, DISPENSARY, INVENTORY, REPORT, CASH BOOK, ADMIN, and Patient Search. The left sidebar shows a Configuration menu with categories like Patient, Consultation, Template, Inventory, User, Insurance, and Others. The main content area is titled 'Customized Fields' and contains a table with the following data:

Label	Category	Input Type
Use tab layout in consultation	User Profile	Check Box
Show "Medical Background" tab by default in consultation	User Profile	Check Box
Preferred Display Language	User Profile	Select
Font Size	User Profile	Select
Body Temp (°C)	Vital	Text Field
BP Systolic (mmHg)	Vital	Text Field
BP Diastolic (mmHg)	Vital	Text Field
Hear Rate (bpm)	Vital	Text Field
RR (l/min)	Vital	Text Field
Weight (kg)	Vital	Text Field
Height (cm)	Vital	Text Field
Waist Circum (cm)	Vital	Text Field
Urine Sugar (mg/dl)	Vital	Text Field
Blood Type	Medical Background	Select
G6PD Status	Medical Background	Select
Smoking History	Medical Background	Select
Unit	Unit	Select
Show Other Doctors' Queue	ClinicSetting	Check Box

At the bottom of the page, there is a footer with the text 'Copyright © CMS 2.x - GPL 2.0' on the left and 'Version 1.0.10937' on the right.

## 2.2 OpenEMR Project

OpenEMR is a popular open source electronic health records and medical practice management system. [3] The project repository can be found [here](#).

The [Features](#) tab from the home page provides vast amounts of information regarding the system including some screenshots of the software.

([List of open-source health software](#))

## 3 Technology Research

### 3.1 Encryption Software

In this section I will document a number of encryption solutions in order to find the best suited technology fit for this application.

Pycrypto (Python package available on PyPi)

<http://www.laurentluce.com/posts/python-and-cryptography-with-pycrypto/>

PyCryptodome (Another python package available on PyPi, ran into some python versioning issues with Pycrypto when testing with ppython.. It was to node, winrandom failed import)

<https://pycryptodome.readthedocs.io/en/latest/index.html>

CryptoDB (Execute SQL over encrypted data and encryption keys chained to user passwords)

#### Database/Storage Technology Research

XtraDB and InnoDB (By default, MariaDB uses the XtraDB storage engine, a performance enhancement fork of the InnoDB storage engine). It is possible to use InnoDB as a plugin in MariaDB.

## 4 Web Frameworks

### 4.1 AngularJS

### 4.2 Django

## 4 Programming Languages

### 4.1 AngularJS

### 4.1 Python

## 5 Cloud Technologies

### 5.1 Azure

<https://docs.microsoft.com/en-us/azure/active-directory/active-directory-devquickstarts-angular>

## References

[1] Mobigator Technology Group, Website - <http://www.mobigator.com/pages/index.asp> 12 Jan. 2017

[2] "CMS 3X" [online] Available at: <http://cms3.hkma.org/pages/index.asp> 13 Jan. 2017

[3] "openEMR" [online] Available at: <http://www.open-emr.org/> 16 Jan. 2017

Take a look at;

<http://codereview.stackexchange.com/questions/110679/simple-login-system-using-python-flask-and-mysql>