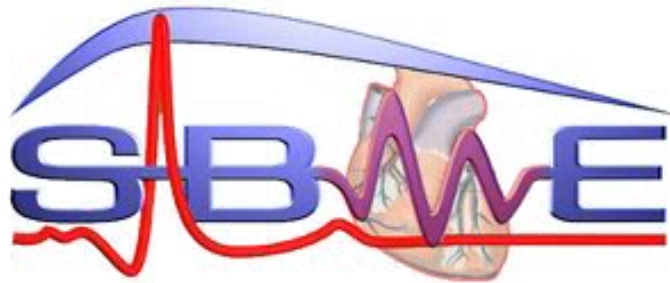




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Database System For CMMS In Tertiary Hospital

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1. DESCRIPTION

Design a database system for CMMS in a tertiary hospital. The main target of this project is to storage and organize the devices data, staff's information, work orders, different types of reports and other data of a hospital in a good and interactive way so the hospital's staff could use it perfectly without any bugs.

2. FEATURES

The website has many features. The user could be an admin, an engineer or a technician, so not all features are available for any user, which make the database more secured. Let's talk about some features starting from the beginning of workflow to the end:

- Login System with security authorization
- Some statistics about the stored data and work orders.
- Viewing each stored data in a separate table in a nice-look view.
- Adding a new data to the database or modifying the existing data.
- A notification system for viewing the work orders to be done.
- Creating different types of work orders for each device in a specific department or for all the devices in a certain department.
- Generate different types of reports such as repair, PPM and daily inspection reports, display and save them as PDF files.

3. WORKFLOW AND RESULTS

In this section we will explain how the website works and the steps from starting the website until generating a certain report.

3.1 LOGIN PAGE

As you see in Figure 1 you need to login first to access the database and use it. And of course, for the sake of security, the users' passwords are encrypted.

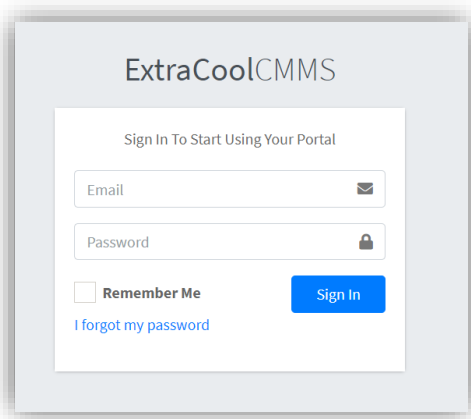


Figure 1: Login Page

3.2 HOME PAGE

After you've logged in you will be redirected to the home page of the website, see **Figure 2**. In this figure the logged in user is an admin so the view is different and he can access different data.

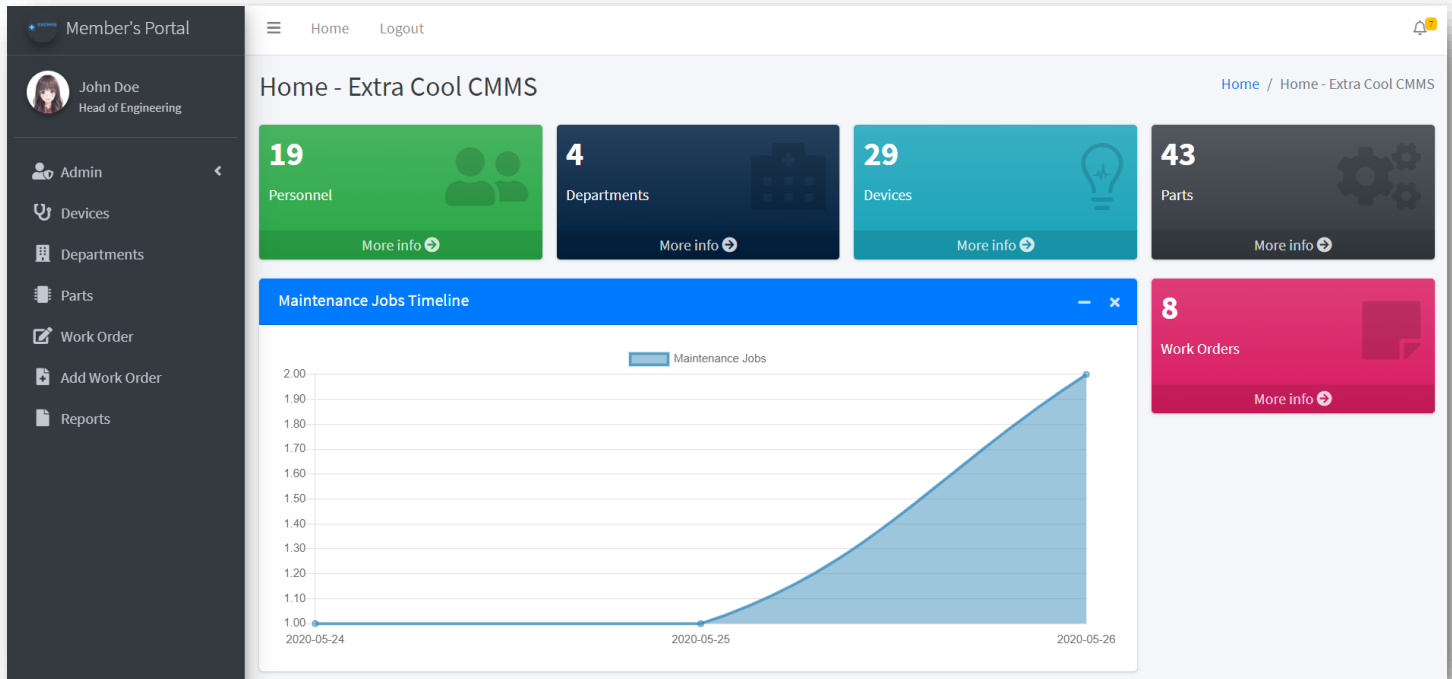


Figure 2: Home Page – Admin

In the home page you could see some information about each part of the database such as the users, departments, devices, parts and the work orders. These data are related to each other and connected together i.e. each department has some devices and each device is formed of some parts.

3.3 DATA TABLES

In the following figures you could see each table of the data we added in the database, as we mentioned above, we're now logged in as an admin, so you would see an option for the adding or deleting operation. We added some features to each table such as searching, sorting and panning for more flexibility and user experience.

3.3.1 DEPARTMENTS DATA

There are four departments in this database as it's a beta version as you could see in Figure 3.

Departments List

[Home](#) / Departments List

+ Add

Erse All

Show 10 entries

Search:

ID	Name	Action
1	Cardiac Catheterization	
2	Surgery Care	
3	Cardiology	
4	Emergency	

Showing 1 to 4 of 4 entries

Previous 1 Next

Figure 3: Departments Table

3.3.2 USERS DATA

The users list is divided to 3 types, an admin, an engineer and a technician, see **Figure 4**. The admin can access more data and make different actions that the engineer or the technician can't do it such as adding a new department, device and part. And only the admin can perform a delete operation to an existing data.

As you see in the figure, each user belongs to one department and has a certain role.

Add Personnel

Show 10 entries

Search:

Name	Email	Birthday Date	Role	Phone Number	Department	Action
Cain Roth	risus.Quisque@Etiambibendumfermentum.net	1989-01-21	Technician	011-559-164-0767	Cardiology	
Clarke Davis	dolor.sit.amet@aaliquetvel.net	1986-10-08	Engineer	011-233-485-6613	Emergency	
Dustin Isaac	Nunc.sollicitudin@interdumliberodui.co.uk	1986-01-04	Technician	011-931-474-5004	Surgery Care	
Eagan Hamilton	vitae.risus@libero.net	1991-07-12	Engineer	011-862-837-5651	Surgery Care	
Fuller Armando	diam@convalliserateget.com	1989-07-18	Engineer	011-880-196-3746	Cardiac Catheterization	
Giacomo Keane	ligula@nectempus.edu	1980-09-03	Engineer	011-952-983-0202	Cardiology	
Grant Neville	sollicitudin.orci.sem@ametconsectetuer.com	1989-08-16	Engineer	011-382-845-7949	Cardiology	
Jane Doe	technician@clinical.com		MRI Technician	01123456789	Cardiac Catheterization	
John Doe	admin@clinical.com		Head of Engineering	01123456789	Cardiac Catheterization	
Kane Dean	justo@non.net	1980-09-17	Technician	011-976-188-0340	Cardiac Catheterization	

Showing 1 to 10 of 19 entries

Previous 1 2 Next

Figure 4: Users List

3.3.3 DEVICES DATA

Devices List

[Home](#) / [Devices List](#)

+ Add

Show 10 entries

Search:

Name	Model	Serial	Import Date	Installation Date	Scrapping Date	Supplying Company	Department	PPM Interval	Delete	Alert
Defibrillator	HEART START XL	US41412124	8 February, 2016	8 February, 2016	13 June, 2019	EG Group	Cardiac Catheterization	30		
Defibrillator	CardioServ	101179906	9 June, 2011	9 June, 2011		EG Group	Cardiology	30		
Diathermy	VIO300D	11378619	8 February, 2016	8 February, 2016		EG Group	Cardiac Catheterization	180		
Diathermy	EP-Shuttle	ST-5687	8 February, 2016	8 February, 2016		El Alamy Group	Cardiac Catheterization	180		
Diathermy	ELEKTROTOM 400	119772	4 April, 2015	4 April, 2015	2 September, 2016	Egyptian Import Office	Emergency	180		
Doppler Ultrasound	Volcano sSi	070 06528 001	8 February, 2016	8 February, 2016		Techno Pharm	Cardiac Catheterization	90		
ECG	Cardio vit AT-102	070-12266	8 February, 2016	8 February, 2016	23 April, 2019	Ghalioungui Trading	Cardiology	30		
ECG	CARDIOVIT AT-102	70.12255	8 February, 2016	8 February, 2016		Ghalioungui Trading	Emergency	30		
ECG	CARDIOVIT AT-102	70.12261	8 February, 2016	8 February, 2016		Ghalioungui Trading	Emergency	30		
ECG	EP-TRACER 70	22-03-13	8 February, 2016	8 February, 2016		Ghalioungui Trading	Cardiac Catheterization	30		

Showing 1 to 10 of 29 entries

Previous

1

2

3

Next

Figure 5: Devices Table

Each device has some important data we need for generating the required reports. The warning icon purpose is to make an alert on this device when any problem occurs to this device or if sudden failure happens. After executing this alert, a new notification would appear in the notifications badge.

3.4 NOTIFICATIONS SYSTEM

After generating a work order, a notification would appear in the notifications badge. Each work order has a certain type such as 'Repair', 'PPM' and 'Daily Inspection'. After creating some work orders:

8 Notifications

Daily

2020-5-26 12:14 PM

Don't Forget The Daily Checkup For Cardiology Department!

Daily

2020-5-26 12:14 PM

Don't Forget The Daily Checkup For Emergency Department!

Daily

2020-5-26 12:14 PM

Don't Forget The Daily Checkup For Surgery Care Department!

Daily

2020-5-26 12:28 PM

Don't Forget The Daily Checkup For Cardiac Catheterization Department!

Repair

2020-5-26 3:08 PM

Department: Emergency

Device: ECG

Serial: 70.12255

Repair

2020-5-26 3:08 PM

Department: Cardiology

Device: Defibrillator

Serial: 101179906

Repair

2020-5-26 3:08 PM

Department: Cardiology

Device: Infusion Pump

Serial: FN60-7225

Repair

2020-5-26 3:08 PM

Department: Surgery Care

Device: Monitor

Serial: 1387-112213

Figure 6: Notifications Bar

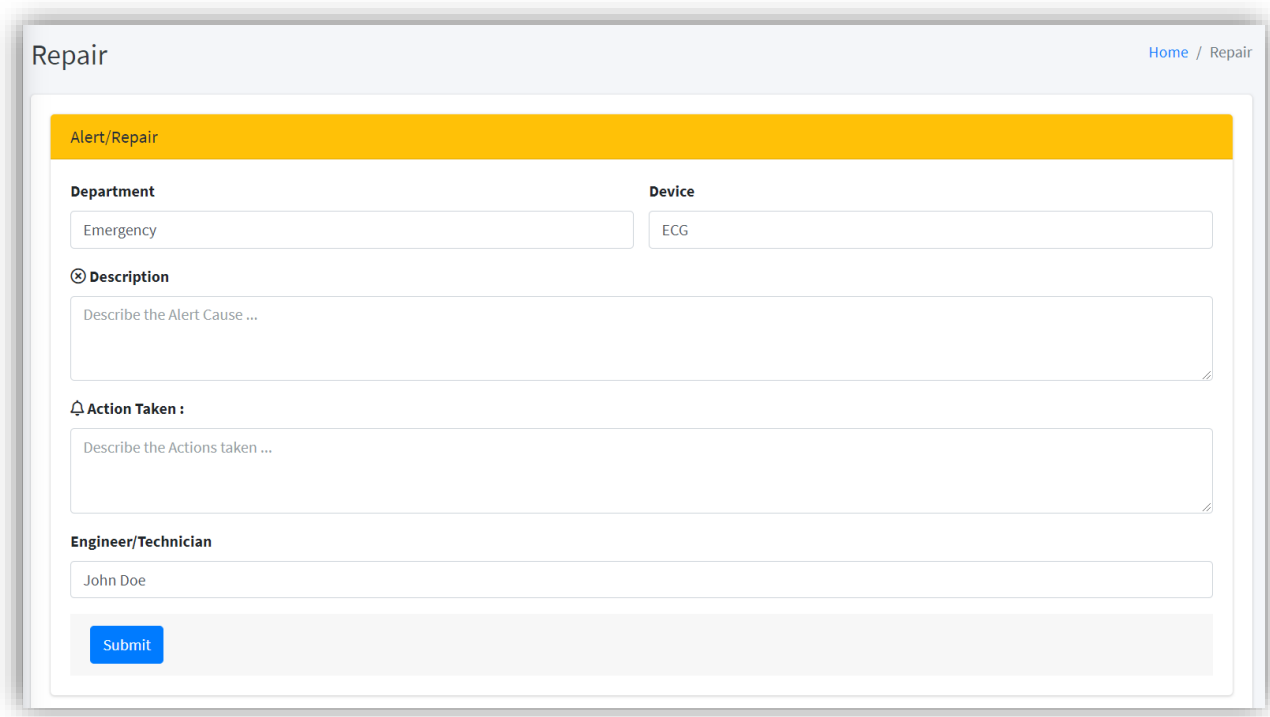
When you click on this notification you would be redirected to a form for creating a new work order on this device with the associated report type in the notification.

3.5 CREATING WORK ORDER

Each work order has different form to fill it with the needed data. You will be redirected to the specific form depending on the type of work order, as you saw previously in the notifications bar, the type of the work order is displayed with some useful data such as department and device names.

3.5.1 REPAIR TYPE

For the ‘repair’ type, the form of creating its work order is shown in **Figure 7**. The department, device and user names are automatically filled after clicking on the notification.



Repair

Home / Repair

Alert/Repair

Department: Emergency

Device: ECG

Description: Describe the Alert Cause ...

Action Taken: Describe the Actions taken ...

Engineer/Technician: John Doe

Submit

Figure 7: Repair Work Order

The user can fill this form with the required information and describe the work order and what he have done.

3.5.2 DAILY INSPECTION TYPE

For the ‘Daily Inspection’ type, the form of creating its work order is shown in Figure 8. In this case it’s for all the devices in surgery care department. The user will fill this check boxes for each device depending on its state. As you see in **Figure 8** below.

Daily Report Form

Engineer/Technician

John Doe

Device	Foreign Substances Removed	Cracks Found	Broken Battery	Damaged Battery	Spare Battery	Broken Cable	Damaged Cable	Spare Cable
Doppler Ultrasound	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient Bed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Diathermy	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Diathermy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
Monitor	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Monitor	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
ECG	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Defibrillator	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Infusion Pump	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

Submit

Figure 8: Daily Inspection Work Order

3.5.3 PPM TYPE

For the 'PPM' type, the form of creating its work order is shown in Figure 9.

Planned Preventive Maintenance Form

Department

Cardiac Catheterization

Device

Diathermy

Read The Following And Check The Applied Procedures

Dust Removal

☐

Surface Cleaning

Lubrication (if Any)

Calibration

☐

☒ State Replaced Parts

Parts ...

☒ State Applied Adjustments

Parts ...

☒ Comments

Parts ...

Engineer/Technician

John Doe

Figure 9: PPM Work Order

After submitting each one of the previous forms, a new work order would be generated and recorded in the database successfully. So, after creating some work orders, here is a list of some recorded work orders that we have made, see Figure 10.

Work list [Home](#) / [Work list](#)

Engineer Name	Date	Device	Department	Task	Done
John Doe	2020-05-26	All	Cardiac Catheterization	Daily	Done
Any	2020-05-24	Patient Bed	Cardiac Catheterization	PPM	Completed
Any	2020-05-26	Diathermy	Cardiac Catheterization	PPM	Pending
Any	2020-05-25	Doppler Ultrasound	Cardiac Catheterization	PPM	Completed
John Doe	2020-05-26	ECG	Cardiac Catheterization	Repair	Done
John Doe	2020-05-26	Infusion Pump	Cardiac Catheterization	Repair	Done

Figure 10: Work Orders List

3.6 GENERATING THE REPORTS

We could generate three different types of reports (Repair, Daily Inspection and PPM). In the sidebar there is a button '**Reports**', it would redirect you to the page of creating a new report, see **Figure 11**.

Reports Extraction [Home](#) / [Reports Extraction](#)

Select Report Type

Repair
▼

Select Department

Cardiac Catheterization
▼

Select Device

All Devices
▼

Select Serial

Serial
▼

Figure 11: Generating Reports

After you click 'button' button, you would see the result of the extracted report in the same page, see **Figure 12**.

Repair Detailed Report [Home](#) / [Repair Detailed Report](#)

Repair Detailed Report

John Doe from Cardiac Catheterization

Created At : Tue May 26 2020 19:45:29 GMT+0200 (Eastern European Standard Time)

— Extra Cool CMMS

Device	Department	Eng/Tech	Description	Action
ECG	Cardiac Catheterization	John Doe	Battery was damaged	Replaced Successfully

Figure 12: Repair Report Result

Another type of the reports is “Daily Inspection” and this is the result when generating its report, see Figure 13.

Daily Detailed Report
[Home](#) / Daily Detailed Report

Daily Detailed Report
John Doe from Cardiology
Created At : Tue May 26 2020 19:39:33 GMT+0200 (Eastern European Standard Time)
— Extra Cool CMMS

Eng/Tech	Device	Serial	Remove Foreign	Cracks ?	Broken Battery	Damaged Battery	Spare Battery	Broken Cable	Damaged Cable	Spare Cable
Grant Neville	Infusion Pump	FN60-722S	Not Done	None Found	None Found	None Found	None Found	None Found	None Found	None Found
Grant Neville	Defibrillator	101179906	Checked	None Found	Checked	None Found	None Found	Checked	None Found	None Found
Grant Neville	Electric Suction Machine	182426	Not Done	None Found	None Found	None Found	None Found	None Found	None Found	None Found
Grant Neville	ECG	070-12266	Not Done	None Found	None Found	Checked	None Found	None Found	None Found	None Found
Grant Neville	Ventilator	2408	Not Done	None Found	None Found	None Found	None Found	None Found	None Found	None Found
Grant Neville	Ventilator	2019	Not Done	None Found	None Found	Checked	Checked	None Found	None Found	None Found
Grant Neville	Electric Patient Bed	114	Not Done	None Found	Checked	None Found	None Found	None Found	Checked	None Found
Grant Neville	Monitor	1387-109741	Not Done	None Found	None Found	None Found	None Found	None Found	None Found	None Found

Save

Figure 13: Daily Inspection Report Result

You could save this report as PDF by clicking on ‘save’ button.

ECC _ Daily Detailed Report.pdf - Foxit PhantomPDF

Form Protect Share Connect Accessibility Help Tutorial Tell me what you want to do

Edit Text Edit Object

Typewriter Highlight

Rotate Pages

Insert Delete Extract

Scan Quick OCR PDF Sign

5/26/2020

ECC | Daily Detailed Report

Daily Detailed Report
John Doe from Cardiology
Created At : Tue May 26 2020 19:39:33 GMT+0200 (Eastern European Standard Time)
— Extra Cool CMMS

Eng/Tech	Device	Serial	Remove Foreign	Cracks ?	Broken Battery	Damaged Battery	Spare Battery	Broken Cable	Damaged Cable	Spare Cable
Grant Neville	Infusion Pump	FN60-722S	Not Done	None Found	None Found	None Found	None Found	None Found	None Found	None Found
Grant Neville	Defibrillator	101179906	Checked	None Found	Checked	None Found	None Found	Checked	None Found	None Found
Grant Neville	Electric Suction Machine	182426	Not Done	None Found	None Found	None Found	None Found	None Found	None Found	None Found
Grant Neville	ECG	070-12266	Not Done	None Found	None Found	Checked	None Found	None Found	None Found	None Found
Grant Neville	Ventilator	2408	Not Done	None Found	None Found	None Found	None Found	None Found	None Found	None Found
Grant Neville	Ventilator	2019	Not Done	None Found	None Found	Checked	Checked	None Found	None Found	None Found
Grant Neville	Electric Patient Bed	114	Not Done	None Found	Checked	None Found	None Found	None Found	Checked	None Found
Grant Neville	Monitor	1387-109741	Not Done	None Found	None Found	None Found	None Found	None Found	None Found	None Found

Figure 14: Report' Result as PDF File