

Infrastructure Management System

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Abstract

Technology cannot be disregarded because it has raised the living standards and sparked revolutions in many facets of contemporary society. In every industry, technology has decreased labor and time requirements, and enhanced production efficiency. A certain technology's innovation eventually makes it a part of society and essential to people's daily lives. The management of infrastructure manually in any organization or institution is a tedious task. In order to make the management of infrastructure in courts automated, an application is developed that maintains every detail of all infrastructures and IT stocks in the courts. Users can view the purchase date, warranty period, and location of the infrastructure in the court. A unique QR code is generated for each piece of furniture and IT stock to access its details. The Infrastructure Management System is touted as a revolution in court management. This application saves time and workload. Moreover, notifications are generated if the service period is nearing, and it would call the service person regarding the repair and service. This management system is found to be effective and efficient.

Keywords: Infrastructure Management System, QR code, stocks, court.

1. Introduction

The Infrastructure Management System (IMS) is a web application used to maintain the infrastructure of Tirupur District Judiciary. There is a huge amount of infrastructure within the court such as table, chairs, benches, IT infrastructures such as laptops, monitors, CPUs, printers, etc. But at present, the number of infrastructures and their related details and

documents such as warranty, Annual Maintenance Contract (AMC), etc., are recorded in log books and the papers are filed. This requires a lot of man power and becomes a monotonous process. Keeping track of the infrastructure manually becomes a time consuming process. The people who maintain logs are also likely to make mistakes and in long run it may affect the overall court infrastructure. In order to overcome the above challenges, these processes need to be automated. Through log books, IMS lessens the physical labour required to maintain server information. It increases departmental efficiency, makes use of online services, establishes a simple platform for top officials to access data for quick decision-making, and contributes to better administration as a whole. It generates a unique QR code that can be placed on the respective infrastructure. When the QR code is scanned, it gives the details of the infrastructure. Hence, this system reduces man power and is time saving.

2. Literature Survey

Paper [1] focused on the activity or function based on the management of infrastructure. It mainly focuses on managing and keeping track of complaints regarding furniture and IT stocks. Using this application, a defective accessory can be picked and an admin report with a specific complaint can be sent. It aids the college in keeping all the accessories safely maintained.

Article [2] proposed an application for asset management information system for making reports related to assets control and management. This application can make business operations easier, particularly when registering, requesting, receiving, and managing items.

Research [4] presented an IMS for educational institutions. The challenges of manual management of infrastructure and how the proposed IMS addresses these challenges were highlighted. The IMS includes features such as an inventory management system, asset tracking, and automated maintenance scheduling. The system was tested in a college campus, and the results showed improved efficiency in infrastructure management. The paper provides insights into infrastructure management systems for educational institutions and can be used as a reference for organizations looking to implement similar systems.

An electronic system was proposed in [5] to improve the management of court infrastructure in Malawi. A mixed-methods approach was used to identify the requirements and design the system. The ECIMS includes asset tracking, maintenance scheduling, inventory management, and reporting. A usability evaluation using the System Usability Scale found that the system was easy to use and had a high level of user satisfaction. The study provides a practical

example of the implementation of electronic infrastructure management systems in a developing country context.

In [6], a comprehensive IMS for schools that covers the management of hardware, software, and network infrastructure was presented. The challenges of managing school infrastructure and how the proposed IMS addresses these challenges were identified. The IMS includes features such as inventory management, remote monitoring, and preventive maintenance. A case study was conducted to demonstrate the effectiveness of the IMS in a Korean elementary school. The study found that the IMS was able to improve infrastructure management efficiency and reduce maintenance costs. The paper provides insights into infrastructure management systems for schools and can be used as a reference for schools looking to implement similar systems.

Paper [7] developed an application to maintain all the inventories in a university to simplify work process, to save time and money. It aids in forecasting, controlling, and managing inventories, boosts productivity, sales, and profitability while lowering expenses.

The study [8] proposed an Integrated Infrastructure Management System (IIMS) for manufacturing industries to improve maintenance planning and resource allocation. The existing challenges in the maintenance of manufacturing infrastructure were identified. The IIMS includes features such as a centralized database, a knowledge management system, and a maintenance planning system. A case study was conducted to demonstrate the effectiveness of the IIMS. The study contributes to the literature on infrastructure management systems for manufacturing industries.

A web-based Facility Management System (FMS) for court buildings was proposed in [9]. The challenges of managing court building facilities and how the proposed FMS addresses these challenges were reviewed. The FMS includes features such as a centralized database, a building maintenance system, and a complaint management system. A case study was conducted to demonstrate the effectiveness of the FMS in a Malaysian court building. The study found that the FMS was able to improve facility management efficiency and reduce maintenance costs. The paper provides insights into facility management systems for court buildings and can be used as a reference for organizations looking to implement similar systems.

Article [10] examined the claim that processes can be used to asset management made by academics working in the systems engineering and asset management sectors. The processes of stakeholder establishing needs, decision management, risk management, information

management, measurement, and life-cycle model management were specifically mentioned in several works in the asset management sector as having direct applicability

3. HARDWARE AND SOFTWARE REQUIREMENTS

A. Hardware Requirements

- **SERVER:** Ubuntu Linux 14. 04
- **Processor:** The processor used for the IMS is a 64-bit processor that includes more memory space (up to 256TB) and more data processing per clock cycle when using an x86 or x64 processor.
- **PHP engine:** The software that runs PHP scripts and resides on the web server is used. The IMS makes use of freely available XAAMP. XAAMP is an open-source software that makes the installation of Apache server easy. Along with Apache server, all the required parts needed to operate the PHP-software is provided by XAMPP.
- **Database server:** Any server that manages database files and executes a network database application (SQL 5.0 or later) is a database server. The developed IMS makes use of the MySQL Server which is a relational database management system. Installation of XAMPP includes MySQL database server. The database was created in order to manage and store information regarding the infrastructure within the court.
- **Internet:** Internet connection is required for software activation.

B. Software Requirements

A. Apache:

Since IMS operates on Linux-based systems, the common Apache web server is used to serve the requests. It is in charge of responding to directory (HTTP) requests from IMS users and providing the requested files and Web pages to manage and keep a track of the infrastructure at the court. Commonly used web browser software like Firefox, Opera, Chromium, or Internet Explorer can be used to request and display the IMS web pages.

B. PHP:

A server-side scripting language called PHP (Hypertext Preprocessor) is used in the IMS software. PHP being the most popular open-source server-side scripting language, is used primarily in IMS development to create dynamic websites and interact with MySQL database for storing and retrieving the data.

C. AJAX:

Asynchronous JavaScript and XML (Ajax) makes asynchronous calls in the background to web server. Hence it produces quick and dynamic web pages on the web browser. By secretly exchanging small amounts of data with the server, AJAX enables web pages to be updated asynchronously. The requested web pages of the IMS are updated in sections instead of an entire page reload.

D. jQuery:

JavaScript programming is being simplified and easily learnable with the help of JQuery. This library of JavaScript is commonly used for web scripting task. With the help of jQuery, many basic activities can be performed, that would otherwise require numerous lines of JavaScript code by calling methods. Manipulation of DOM elements and their attributes is simple with the help of jQuery.

E. Bootstrap:

A powerful front-end framework called Bootstrap is used to build contemporary websites and web apps. Bootstrap saves web development time because it includes built-in designs and responsive grid system that makes easy to customize. Despite having a ton of HTML and CSS templates for UI interface elements like buttons and forms, it is open-source and free to use. Using bootstrap make its browser compatible.

F. HTML:

HTML is a programming language utilized to organize content on web pages, allowing authors to create and publish online documents with headings, text, tables, lists, images, and more. Hypertext links provide a quick means to access internet content, while forms enable remote transactions for ordering, reserving, or gathering information. Multimedia content like videos, sound samples, and spreadsheets can be easily integrated into HTML documents.

G. CSS:

Cascading Style Sheets (CSS) is the language used to specify how web pages are presented regarding their color, design, and typography. CSS makes it possible to adjust the appearance of web pages to suit various types of devices such as printers, small screens, and large screens. Unlike HTML, CSS is not dependent on any XML-based markup language and can be used with any of them. The separation of HTML and CSS makes it easier to manage websites, share style sheets across pages, and customize pages for different scenarios.

H. MySQL:

IMS makes use of the relational database management system MySQL which is free and open source. It is relational because it saves such data in several "tables", which enables saving all infrastructures and court property information and makes the retrieval of data much easier.

4. SYSTEM ANALYSIS AND DESIGN

Infrastructure management system is a web application used to store and maintain the information of all infrastructures within the court premises. The user can login into the system with the help of username and password to make use of the application. It consists of six modules. They are,

1. Data entry – The infrastructure details can be inserted with the help of this module.
2. Update and delete – Once entered, the infrastructure details can be updated or deleted.
3. QR code generator – It generates the QR code for each property or building.
4. Report generator – Various reports can be generated using the filters provided.
5. Reminders – The user gets reminders and notifications at critical times
6. Complaints and call booking – Complaints regarding the infrastructure can be sent to the respective person.

The system is designed such that the user can see the dashboard once the user logs in. Various forms are displayed within the data entry section. Under the update tab, all the records are displayed along with an option to update, delete, and generate QR code. Under the report generator, various dropdown filters are available to generate different reports.

A. Dataflow Diagram (DFD)

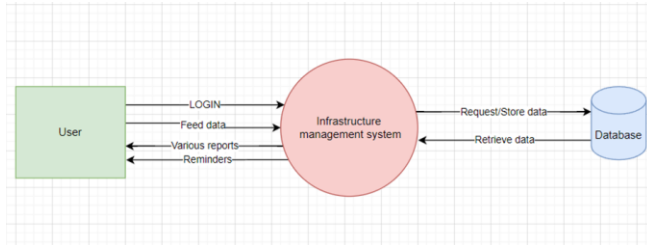


Figure 4.1. DFD- Level 0

The users can login, feed data, receive reminders and reports from the Infrastructure Management System, which are shown in Fig.4.1.

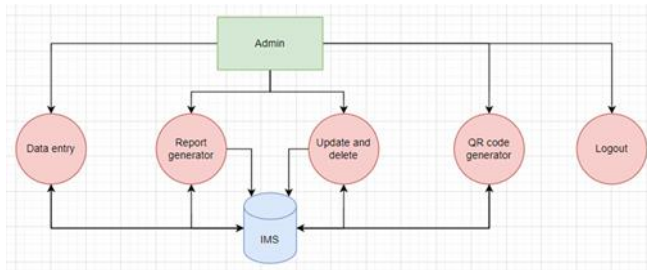


Figure 4.2. DFD-Level 1

Fig.4.2 displays all the core modules of the Infrastructure Management System such as Data entry, Report generator, Update and delete details, QR code generator and finally logout of the system. All these modules store and retrieve data from the IMS database.

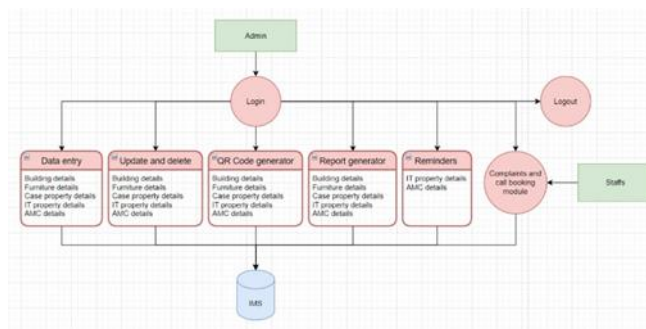


Figure 4.3. DFD-Level 1

Fig.4.3 provides a more detailed view of the Infrastructure Management system. It displays all the sub modules within the core modules mentioned in Fig 4.2.

B. System Users

1. Admin Panel
2. Staffs

5. PROPOSED SOLUTION

This paper presents a solution that automates the tiring and error prone process of keeping the records. The system has two users:

1. The people who keep track of the infrastructure
2. Other officials in the court

Each of the users can login into the system using their respective login credentials which is their username and password. Different dashboards are available for the 2 users.

When user of type 1 logs into the system, a dashboard as shown in Fig.5.1 is loaded. The user has the following options: The ‘data entry’ option allows to enter the respective details of buildings, general property, case property, IT stocks and details about AMC. Clicking on any one of these, displays a form to enter the details and when clicked submit, the details are stored in the database.

The ‘update data’ option helps the users in updating the data by displaying a table where a row that was previously entered can be selected. The data can also be deleted with the help of this option. Along with update and delete, the system also generates a unique QR code for each infrastructure. The QR code contains all the details encrypted within it. When scanned using QR code scanner, the details can be viewed instantly.

The next feature is ‘report generation’ which comes under the ‘query generator’ option. It generates various kinds of reports by allowing the user to choose the possible constraints from the available fields. The reports are generated in the form of tables and can also be downloaded in the form of pdf for future use. The ‘view call bookings’ option allows the user to view the complaints made by other officials in the court regarding any queries with their

infrastructure or IT products. Once the complaints are rectified or been notified to the service provider, the status of the complaint is made completed.

Under the notifications tab, the user can view all the notifications such as warranty or AMC expiry. When user of type 2 logs in to the system, a dashboard as shown in Fig.5.2 is loaded. The user has the following options:

‘Call book’ option allows the officials to place their complaints regarding their IT products or any other general infrastructure in order to notify the type 1 user. Under the ‘My Bookings’ tab, the officials can view their previous bookings and their status.

Finally, both users can logout of the system

A. Home Page



Figure 5.1. Home Page

Fig.5.1 displays the home page that loads as soon as the user logs in and gives a brief description of Tiruppur court.

B. Login Page

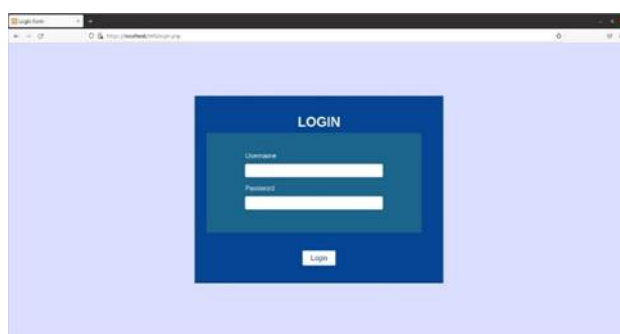


Figure 5.2. Login Page

Fig.5.2 is the login page that asks for the username and password to login to the system.

C. Data entry - Building details

The screenshot shows a web browser window with the title 'Data Entry for Buildings'. On the left is a blue sidebar with navigation links: Home, Data Entry (selected), Register, General property, Case Property, IT services, Update Data, Query Generator, View Call Bookings, Notifications, and Logout. The main content area contains a form with the following fields: District (dropdown), Suburb (text), Village (text), Block Survey No. (text), Description of use (text area), and Value (text). A 'Save' button is located at the bottom right of the form.

Figure 5.3. Data entry - Building details

D. Data entry - Furniture details

The screenshot shows a web browser window with the title 'Data Entry for Furnitures'. The sidebar is identical to the previous figure. The main content area contains a form with the following fields: Furniture Name (dropdown), Quantity (text), Date of purchase (date picker), Court ID (text), Court name (text), Department name (text), and Room Number (text). A 'Save' button is located at the bottom right of the form.

Figure 5.4. Data entry - Furniture details

E. Data entry - Case property details

The screenshot shows a web browser window with the title 'Data entry for Case Details'. The sidebar is identical to the previous figures. The main content area contains a form with the following fields: Case No. (text), Date of case (date picker), Charge sheet No. (text), Prater At the Police (text), Description of properties (text area), Serial No. (text), Vehicle property (text), Officer properties (text), Particulars of vehicles for disposal (text), Section of case (text), and Date of order for disposal (date picker). A 'Save' button is located at the bottom right of the form.

Figure 5.5. Data entry - Case property details

F. Data entry - IT stocks details

Data Entry for IT Stocks

Product Name	
Brand Name	
Model Name	
Serial No	
Computer Name	
Cpu Name	
Project Paid	
Installed Year	
Date Of Purchase	
Expiry	

Save

Figure 5.6. Data entry - IT stocks details

G. Data entry - AMC details

Data Entry for AMC Details

Description of IT Products	
Basic Cost (Previous Unit)	
Quantity in Nos	
Total Cost Price in Rs	
AMC Cost not exceeding 10% as per C.O.Ms.No.1 dated 03.03.2005	
Procedure under Phase 1 of monthly Project Phase 2 of monthly Project Phase 3 of monthly Project	
Expiry of Warranty Period	
Other Maintenance amount required in Financial Year	

Save

Figure 5.7. Data entry - AMC details

H. Update - Building details

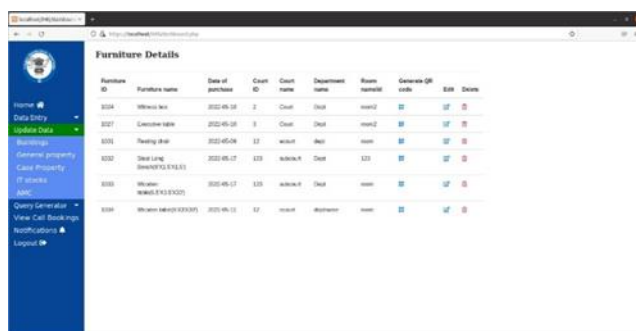
Building Details

Building id	
District	
Taluk	
Village	
Town Survey No	
Description of area	
Value	

Save

Figure 5.8. Update - Building details

I. Update - Furniture details



Furniture ID	Furniture name	Date of purchase	Count	Count name	Department name	Room number	Generate QR code	Status
0104	Upholster bed	2022-05-08	2	Count	Dept	room2		
0107	Upholster table	2022-05-08	2	Count	Dept	room2		
0101	Reading chair	2022-05-08	12	Count	Dept	room		
0102	Desk Lamp (Barcode: 574315151)	2022-05-17	120	Barcode	Dept	121		

Figure 5.9. Update - Furniture details

J. Update – Case property details



Case No	Date of case	Number of charge sheet	Name of the station	Serial No	Inductance property	Other properties	Status of the Judge or Registrar	Particulars of orders	Section of law	Date of order for disposal	Signature of the party	Date received	Status of the Judge or Registrar	Date of execution	Amount realized	Date of receipt of state proceeds
2016	2022-05-04	31	station	1	property	proceedings	status	particulars	section	2022-05-14	sign	2022-05-27	status	2022-05-27	20000	2022-05-27
2012	2022-05-17	28	station	10	property	proceedings	status	particulars	section	2022-05-28	sign	2022-05-31	status	2022-05-31	20000	2022-05-31
2018	2022-05-24	31	station	10	property	proceedings	status	particulars	section	2022-05-29	sign	2022-05-31	status	2022-05-31	20000	2022-05-31

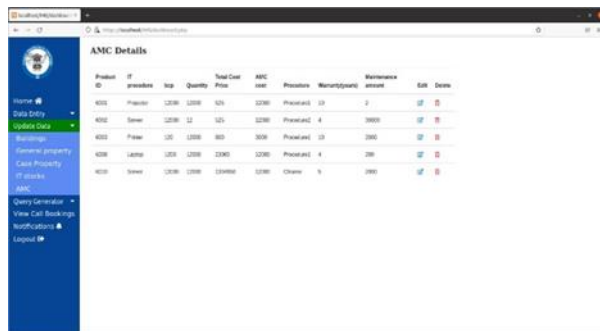
Figure 5.10. Update – Case property details

K. Update – IT stock details

Product Name	Brand Name	Model No	Serial No	Complete Name	Count	Project Name	Installed Year	Date of Purchase	Expiry Date	Generate QR code	Status
Lenovo	Yr	125	12	Lenovo	1220	2016	2022-05-12	2024-05-31			
Lenovo	Yr	125	12	Lenovo	1220	2016	2022-05-12	2024-05-31			
Lenovo	Yr	125H	12	Lenovo	1220	2016	2022-05-12	2024-05-31			

Figure 5.11. Update – IT stock details

L. Update - AMC details



Product ID	IT	Processor	Top	Quantity	Total Cost	AMC cost	Processor	Warranty/years	Maintenance cost	Edit
4001	Processor	12000	12000	520	12000	12000	Processor	10	0	
4002	Server	12000	12	120	12000	12000	Processor	4	30000	
4003	Power	120	12000	800	3000	12000	Processor	10	1000	
4004	Laptop	1200	12000	12000	12000	12000	Processor	4	200	
4005	Server	12000	12000	120000	12000	12000	Chassis	5	2000	

Figure 5.12. Update - AMC details

Figures 5.3 – 5.12 show the data entry and update forms for various categories of infrastructures within the court.

M. QR code generation

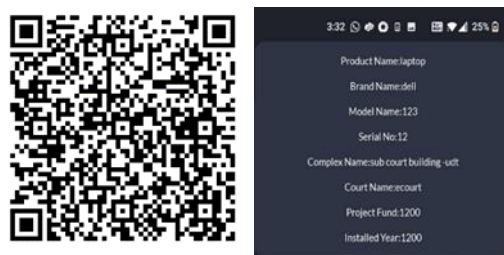
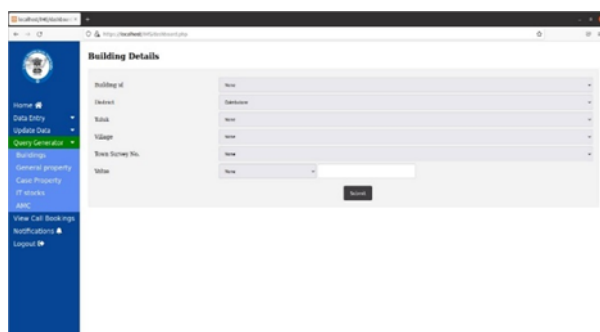


Figure 5.13. QR code generation

Fig.5.13 shows the QR code generated for a sample infrastructure and the corresponding details that the QR code holds.

N. Query generator - Building details



Building id: [dropdown]
District: [dropdown]
Taluk: [dropdown]
Village: [dropdown]
Town Survey No.: [dropdown]
Name: [text input]
[Query button]

Figure 5.14. Query generator - Building details

O. Query generator - Furniture details

The screenshot shows the 'Furniture Details' query generator interface. On the left is a blue sidebar with navigation links: Home, Data Entry, Update Data, Query Generator (highlighted), Bookings, General property, Case Property, IT Stocks, View Cell Bookings, Notifications, and Logout. The main content area is titled 'Furniture Details' and contains a form with the following fields: Furniture ID, Furniture Name, Case ID, Case Name, Department Name, Room ID, and Value. Each field has a dropdown menu with 'New' as the selected option. A 'Search' button is located at the bottom right of the form.

Figure 5.15. Query generator - Furniture details

P. Query generator – Case Property detail

The screenshot shows the 'Case Property Details' query generator interface. The sidebar is identical to the previous figure. The main content area is titled 'Case Property Details' and contains a form with the following fields: Case No, Name of the station, Date of Case, Section of case, Date of order of disposal, Date returned, Date of receipt, Date of constitution of state previously to assembly, and Amount received. Each field has a dropdown menu with 'New' as the selected option. A 'Search' button is located at the bottom right of the form.

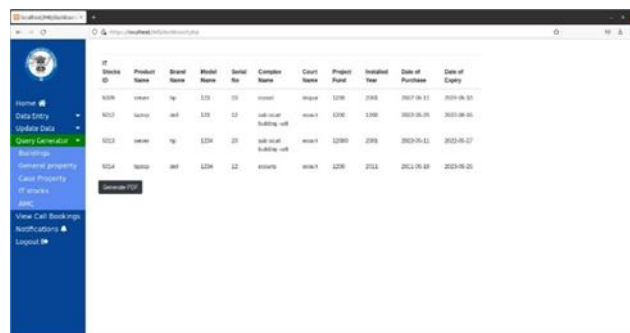
Figure 5.16. Query generator – Case Property details

Q. Query generator – IT Stocks details

The screenshot shows the 'IT Stocks' query generator interface. The sidebar is identical to the previous figures. The main content area is titled 'IT Stocks' and contains a form with the following fields: Stock ID, Product Name, Brand Name, Model Name, Serial No, Complete Name, Brand Name, Project Name, and Issued Date. Each field has a dropdown menu with 'New' as the selected option. A 'Search' button is located at the bottom right of the form.

Figure 5.17. Query generator – IT Stocks details

R. Generate PDF – IT Stocks details



IT Stock ID	Product Name	Brand Name	Model Name	Serial No	Computer Name	Count Name	Product Price	Installed Year	Date of Purchase	Date of Expiry
1006	Lenovo	hp	125	20	Lenovo	Lenovo	1250	2018	2017-04-11	2024-04-11
1013	Lenovo	hp	125	22	Lenovo	Lenovo	1250	2018	2017-04-11	2024-04-11
1013	Lenovo	hp	125	20	Lenovo	Lenovo	1250	2018	2017-04-11	2024-04-11
1014	Lenovo	hp	125	22	Lenovo	Lenovo	1250	2018	2017-04-11	2024-04-11

Figure 5.18. Generate PDF – IT Stocks details

S. Query generator – AMC details

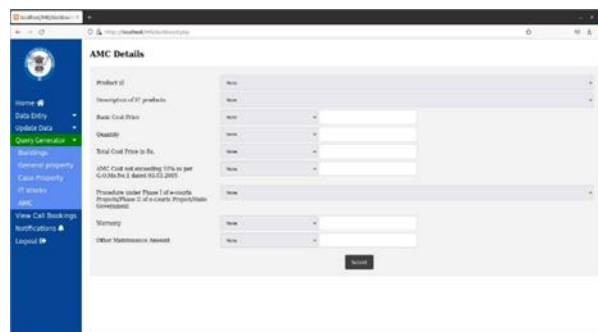


Figure 5.19. Query generator – AMC details

Figures 5.14 – 5.19 show the query generation module that contains various filters that could be added to generate different kinds of reports.

T. Notifications

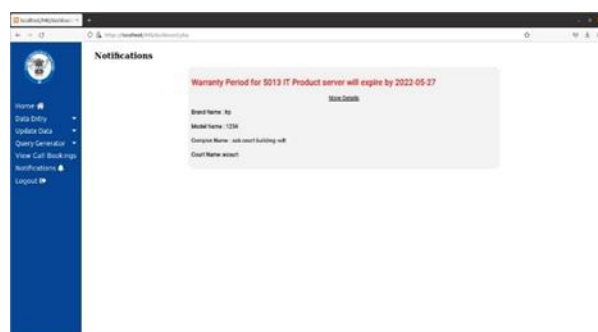


Figure 5.20. Notifications

U. Call Booking in System User

The screenshot shows a web browser window with the URL http://localhost:8080/infrastructure_management_system/user_profile.html. The page title is 'Call Booking Details'. On the left is a blue sidebar with navigation links: Home, Call Booking, My Bookings, and Logout. The main content area contains a form with the following fields: User ID (text), Name (text), Department (text), Intercom no. (text), User Mail ID (text), Property (text), Date of call booking (text), Block (text), Problem (text), and Status (text). A 'Book call' button is located at the bottom right of the form.

Figure 5.21. Call Booking in System User

Fig.5.21 displays the form for booking complaints regarding any infrastructure

V. View My Bookings in System User

The screenshot shows a web browser window with the URL http://localhost:8080/infrastructure_management_system/user_profile.html. The page title is 'View My Bookings'. On the left is a blue sidebar with navigation links: Home, Call Booking, My Bookings, and Logout. The main content area displays a table with the following columns: Call ID, Name, Department, Intercom no., User Mail ID, Property, Date of call booking, Block, Problem, and Status. The table contains three rows of data:

Call ID	Name	Department	Intercom no.	User Mail ID	Property	Date of call booking	Block	Problem	Status
1001	John Doe	IT	1234567	john@gmail.com	London	2022-05-23 10:00:00	10	Waiting need to connect	Canceled
1002	John Doe	IT	123456	john@gmail.com	London	2022-05-23 10:00:00	10	To be removed	Pending
1003	John Doe	IT	123456	john@gmail.com	London	2022-05-23 10:00:00	10	Not working	Pending

Figure 5.22. View My Bookings in System User

W. View Call Bookings from Admin Side

The screenshot shows a web browser window with the URL http://localhost:8080/infrastructure_management_system/admin_profile.html. The page title is 'View Call Bookings'. On the left is a blue sidebar with navigation links: Home, Data Entry, Update Data, Query Generator, View Call Bookings, Notifications, and Logout. The main content area displays a table with the following columns: Call ID, Name, Department, Intercom no., User Mail ID, Property, Date of call booking, Block, Problem, and Done. The table contains two rows of data:

Call ID	Name	Department	Intercom no.	User Mail ID	Property	Date of call booking	Block	Problem	Done
1001	John Doe	IT	1234567	john@gmail.com	London	2022-05-23 10:00:00	10	To be removed	Done
1002	John Doe	IT	123456789	john@gmail.com	London	2022-05-24 10:00:00	10	To be removed	Done

Figure 5.23. View Call Bookings from Admin Side

Figures 5.22 and 5.23 show the page that displays all the call bookings along with their status.

6. Conclusion

The Infrastructure Management System (IMS) operates 24/7 that users can access any time for all the infrastructure management purposes of district judiciary, Tiruppur. The proposed IMS automates the process of maintaining records and tracking information related to infrastructure and IT stocks in the courts. This minimizes the need for manual entry and reduces the chances of errors or omissions. It also allows for quick and easy access to information about the location, purchase date, warranty period, and other details of infrastructure and IT stocks in the courts. This improves the efficiency of court operations and saves time. This can handle all infrastructure properties and can track all the properties using QR code. When put all together, a well-executed solution will help the organization be more productive and achieve its mission. This system could be enhanced in the future by incorporating GPS tracking for all infrastructures available in the court.

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