# Hospital Equipment Maintenance Management System (HEMMS)

## ER Diagram Documentation

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# 1. System Overview

The Hospital Equipment Maintenance Management System (HEMMS) is designed to manage, track, and maintain all hospital equipment efficiently, ensuring high availability of critical medical devices while reducing downtime and maintenance costs.

# 2. Entities and Attributes

## 2.1 Departments

- **PK DeptID** : NUMBER — Primary Key
- **DeptName** : VARCHAR2(50) — Name of the department
- **Location** : VARCHAR2(100) — Physical location in the hospital

- **HeadOfDept** : VARCHAR2(100) – Name of department head

- **Phone** : VARCHAR2(20) – Contact number (optional)

# 2.2 Equipment

- **PK Equipment ID** : NUMBER – Primary Key

- **Serial Number** : VARCHAR2(50) – Unique identifier (UNIQUE)

- **Name** : VARCHAR2(100) – Equipment common name

- **Category** : VARCHAR2(50) – e.g., Imaging, Life-Support, Monitoring, Surgical

- **Manufacturer** : VARCHAR2(100)

- **Model** : VARCHAR2(100)

- **Purchase Date** : DATE

- **Purchase Cost** : NUMBER(12,2)

- **Warranty Expiry** : DATE

- **Status** : VARCHAR2(20) – Active | Under Maintenance | OutOfService | Retired

- **FK DeptID** : NUMBER → References Departments

# 2.3 Technicians

- **PK TechID** : NUMBER – Primary Key

- **Full Name** : VARCHAR2(100)

- **Contact** : VARCHAR2(30) – Phone/Email

- **Specialty** : VARCHAR2(100) – e.g., Biomedical, Electrical, Mechanical

- **HireDate** : DATE

- **Is ACTIVE** : CHAR(1) – 'Y' or 'N' (Default 'Y')

# 2.4 Users

- **PK User ID** : NUMBER – Primary Key

- **Username** : VARCHAR2(30) – Unique login name

- **Full Name** : VARCHAR2(100)

- **Role** : VARCHAR2(20) – Admin | Technician | DeptHead | RegularUser

- **FK DeptID** : NUMBER → References Departments (nullable for Admin)

- **PasswordHash** : VARCHAR2(255) – Securely hashed password

# 2.5 Alerts_Issues

- **PK AlertID** : NUMBER – Primary Key

- **FK EquipmentID** : NUMBER → References Equipment (ON DELETE CASCADE)

- **ReportedBy** : NUMBER → References Users

- **DateReported** : DATE – Default SYSDATE

- **IssueDescription** : VARCHAR2(1000)

- **Priority** : VARCHAR2(20) – Low | Medium | High | Critical

- **Status** : VARCHAR2(20) – Open | Assigned | Resolved | Closed

# 2.6 Maintenance

- **PK MaintenanceID** : NUMBER — Primary Key

- **FK EquipmentID** : NUMBER → References Equipment (ON DELETE CASCADE)

- **FK TechID** : NUMBER → References Technicians

- **MaintenanceDate** : DATE — Actual date work was done

- **ScheduledDate** : DATE — For preventive maintenance

- **MaintenanceType** : VARCHAR2(20) — Preventive | Corrective | Inspection

- **Cost** : NUMBER(10,2)

- **Description** : VARCHAR2(2000) — Detailed work performed

- **Status** : VARCHAR2(20) — Scheduled | InProgress | Completed | Cancelled

- **ApprovedBy** : NUMBER → References Users (optional)

# 3. Relationships (Crow's Foot Notation)

Departments (1) ———< Equipment (n)
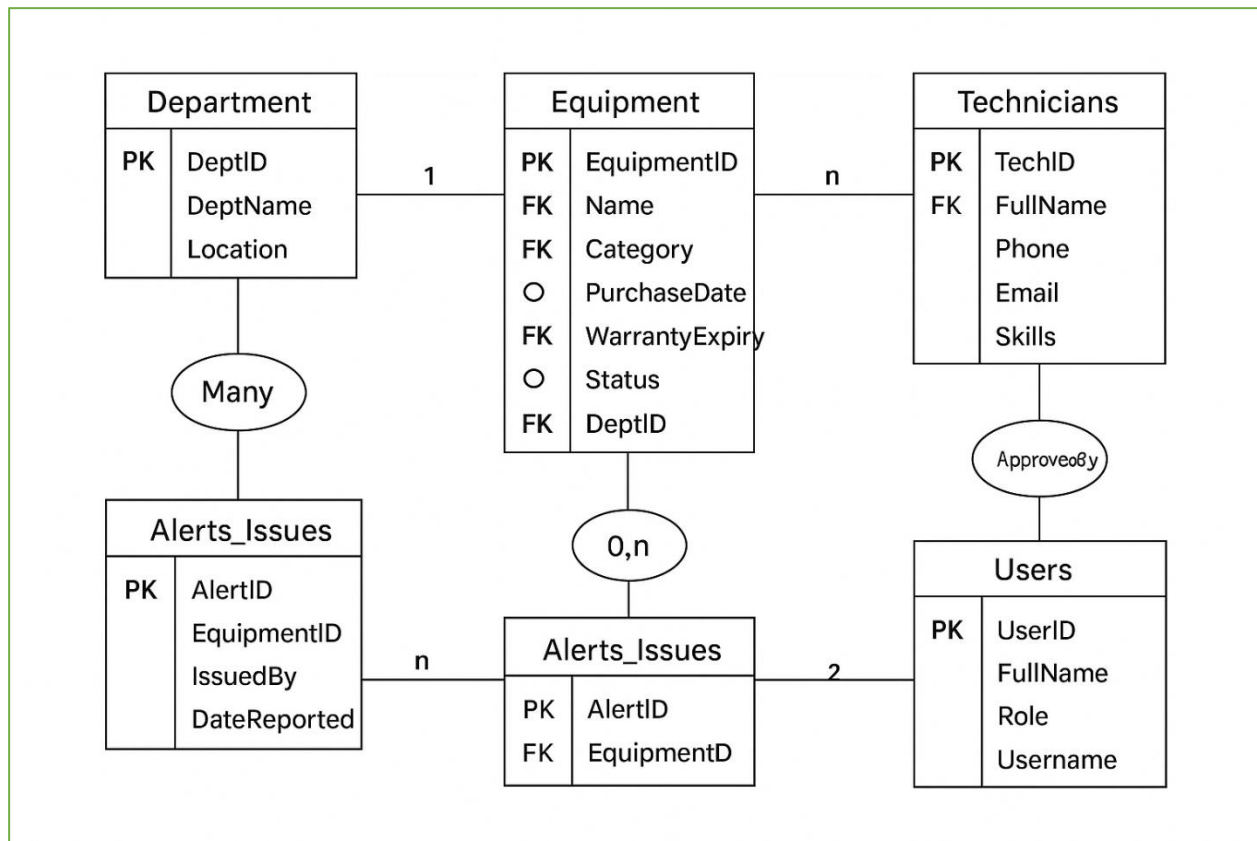
Equipment (1) ———< Maintenance (n)

Equipment (1) ———< Alerts_Issues (n)

Technicians (n) ———> Maintenance (n)     [Many-to-Many resolved via junction]

Users (n) ———> Alerts_Issues (1)     [ReportedBy]

Users (0,n) ——> Maintenance (0,n)     [ApprovedBy – optional]

**ER   DIAGRAM**

4. Key Design Decisions & Highlights

• All equipment belongs to a department → enables department-wise reporting and budgeting.

• Alerts_Issues table captures failures immediately and supports priority-based escalation.

• Maintenance table serves as both scheduled preventive and corrective records.

• Users table supports role-based access control (RBAC) and full audit trail.

• Optional ApprovedBy field allows department heads or admins to sign off expensive repairs.

• ON DELETE CASCADE on Equipment → Alerts and Maintenance ensures data integrity when equipment is retired.

5. Normalization Level

   The logical model is in **Third Normal Form (3NF)** with no transitive dependencies and full referential integrity.