Term Project

WorkD

Chandra Teja Peddi

Jonathan Moreno

Saiprasanth Paladugula

Vijaybhaskar Kothapally

Fowler College of Business, San Diego State University

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Morteza Safaei Pour

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1. Introduction

"WorkD – Work at Your Doorstep" is an innovative service delivery platform designed to streamline the process of booking and managing appointments for a variety of household and personal services. It allows you to continue working from your own desk. Our database management system is designed to connect customers with registered professionals. These experts provide offerings such as beauty salon treatments (haircuts, face masks, hair spa etc.), plumbing (broken pipe, faucets installation etc.), electrical and electronic fixes (home appliances, electric circuits, AC/heater etc.), and general home upkeep (deep cleaning, gardening, packing, and moving etc.). By fusing a user-friendly interface with a resilient backend system, WorkD guarantees a seamless encounter for both providers and clients, permitting appointments to be planned at times fitting for the customer.

WorkD's Database Management System considerably enhances operational effectiveness by connecting customers and experts. It automates appointment planning, enables notifications to be dispatched to experts and customers, and automatically produces invoices based on the work executed. This decreases manual workload and potential mistakes. Experts can handle their schedules more efficiently, while customers enjoy the convenience of reserving and tracking their appointments, making seamless payments, and receiving real-time notifications. By centralizing customer data, including past appointments, preferences, and feedback, WorkD offers a customized service experience. The system also amplifies communication between customers and service providers, resulting in an all-around superior encounter.

WorkD fulfills a variety of use cases, addressing common household needs. For instance, a user can book a haircut or a facial treatment from the comfort of their home, schedule a plumber to fix a leak, arrange for an electrician to repair an appliance, or organize a deep cleaning session pre-move. WorkD can administer bookings, dispatch experts based on location and availability, and handle billing and feedback collection proficiently. Furthermore, experts in appliance repair, electronics, or moving services can utilize this system to streamline the process of appointment booking and service history tracking. Each of these services is designed to be seamless from booking to execution, reflecting WorkD's dedication to providing exceptional service delivery.

In conclusion, WorkD's versatile and efficient DBMS is not only a worthwhile asset for service-oriented businesses but also enhances the overall customer experience by bringing a wide range of services to the doorstep with just a few clicks. By prioritizing user convenience, WorkD aims to revolutionize the way people manage home care needs.

2. Conceptual Data Modeling and Database Design

2.1. Business Rules

2.1.1. Entities and Attributes

Customers (CustomerID (PK), CustomerFirstName, CustomerLastName, Gender, Mobile, Email, Address)

Professionals (ProfessionalID (PK), ProfessionalFirstName, ProfessionalLastName, Profession, Bio, Mobile, Email, Address, ExperienceInYears)

Appointments (AppointmentID (PK), AppointmentDate, AppointmentTime, AppointmentPriority, ProfessionalID (FK), CustomerID (FK), ServiceCategoryID (FK), ServiceSubCategoryID (FK))

Reviews (ReviewID (PK), Review, AppointmentID, Rating)

Payments (PaymentID (PK), Amount, PaymentMethod, PaymentStatus, PaymentDate, AppointmentID (FK), InvoiceID (FK))

Invoice (InvoiceID (PK), InvoiceAmount, InvoiceDate, ServiceID (FK), PartID (FK))

Notifications (NotificationID (PK), NotificationType, Description, NotificationTime, NotificationStatus, ApppointmentID (FK))

ServicesCompleted (ServiceID (PK), ServiceDescription, AppointmentID (FK))

ServiceCategories (ServiceCategoryID (PK), ServiceSubCategoryID (PK), ServiceCategory, ServiceSubCategory)

SuppliesUsed (PartID (PK), PartName, Brand, Description, Quantity)

WorkEquipment (EquipmentID (PK), EquipmentName, EquipmentBrand, EquipmentQuantity, ProfessionalID (FK))

PremiumCustomers (MembershipID, CustomerID (PK, FK), MembershipType, MembershipExpiryDate)

2.1.2. Relationships among the entities

The relationship between reviews and appointments is a "one-to-one" association, indicating that each appointment corresponds to one and only one review, and vice versa.

The relationship between customers and appointments is characterized as "one and only one to zero or many." This means that each customer can have either zero or many appointments, but each appointment is associated with one and only one customer.

The relationship between payments and appointments is described as "one or many to one and only one." This indicates that each payment is associated with only one appointment, but an appointment can have one or many appointments.

The relationship between payments and invoices is characterized as "one or many to one and only one." This means that each invoice can be associated with one or many payments, but each payment is linked to one and only one invoice.

The relationship for professionals to work equipment is "one and only one to one or many." This means that each professional is associated with one or many pieces of work equipment, but that work equipment can be associated with one and only one professional.

The relationship between appointments and notifications is described as "one or many to one and only one." This indicates that each appointment can be associated with one or many notifications, but each notification is specifically linked to one and only one appointment.

The relationship between professionals and appointments is described as "zero or many to one and only one." This signifies that a professional may be associated with zero or many appointments, but each appointment is specifically linked to one and only one professional.

The relationship between service categories and appointments is characterized as "zero or many to one and only one." This means that a service category may be associated with zero or many appointments, but each appointment is specifically linked to one and only one service category.

The relationship between an invoice and supplies used is described as "zero or many to one and only one." This means that an invoice may be associated with zero or many instances of supplies used, but each instance of supplies used is specifically linked to one and only one invoice.

The relationship involving the "ServicesCompleted" associative entity between "Appointments" and "Invoice" entities can be described as follows:

ServicesCompleted to Appointments: "ServicesCompleted" is associated with "Appointments" in a "one or many to one and only one" relationship. This means that each instance of "ServicesCompleted" is linked to one and only one appointment, while an appointment can be associated with one or many instances of "ServicesCompleted."

ServicesCompleted to Invoice: Similarly, "ServicesCompleted" is associated with "Invoice" in a "one or many to one and only one" relationship. This signifies that each instance of "ServicesCompleted" is linked to one and only one invoice, while an invoice can be associated with one or many instances of "ServicesCompleted."

In an overlapping subtype relationship where "premium customers" is a subtype of the super type "customers" entity, the worded relationship can be described as follows: A customer can simultaneously belong to both the "premium customers" subtype and the general "customers" category. In other words, a customer may exhibit characteristics of both a regular customer and a premium customer concurrently.

2.2. Conceptual Data Model EER Diagram: LucidChart
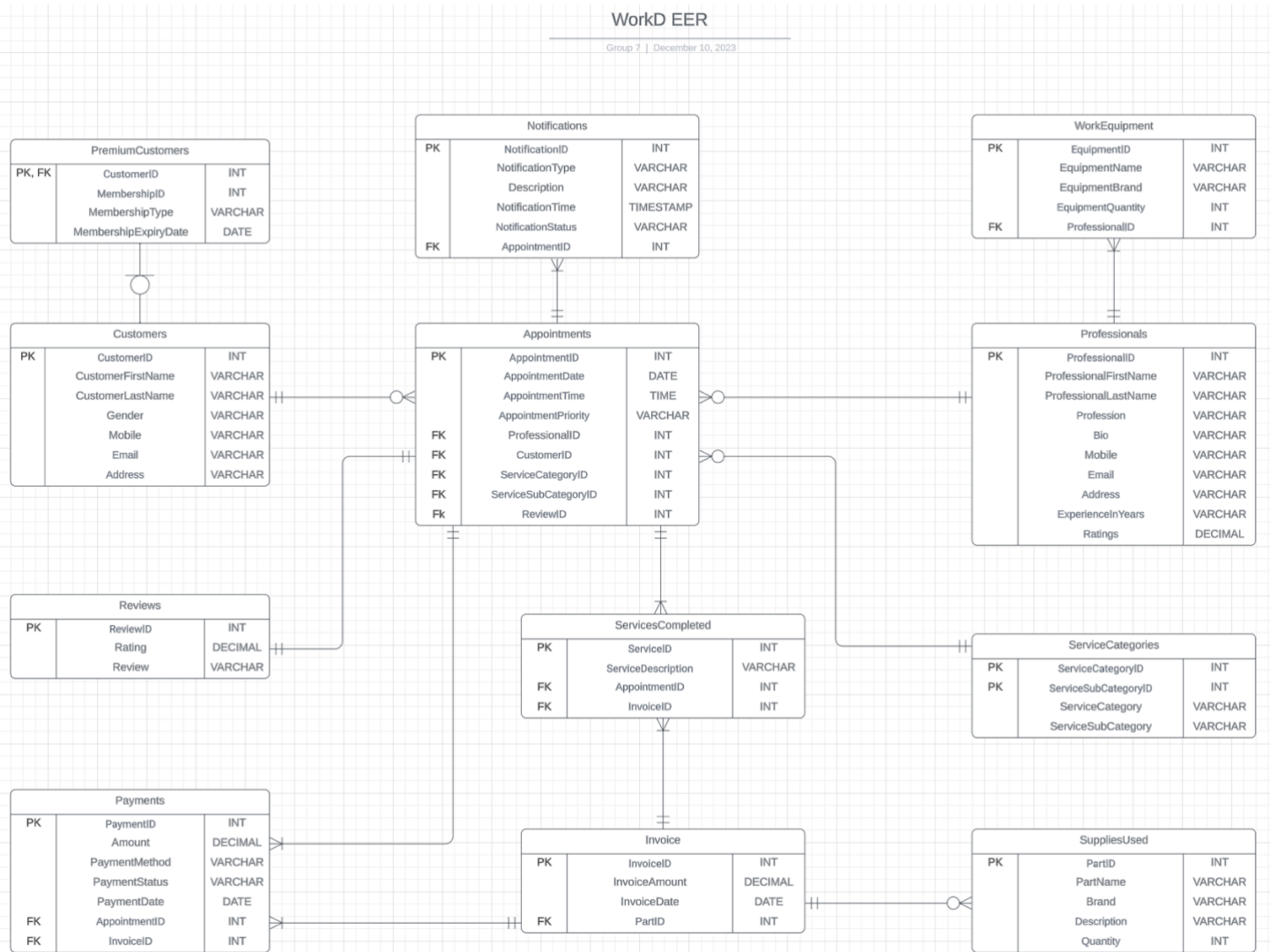
The Extended Entity Relationship Diagram for the enterprise "WorkD" depicts an advanced database schema that outlines the intricate relationships and hierarchies between entities related to the service enterprise. It includes entities such as Customers and PremiumCustomers (sub-type), which inherit from generalized customers entity, allowing for shared attributes while also defining premium specific attributes like MembershipType and MembershipExpiryDate.

Other key entities for this enterprise are Appointments, Professionals and ServicesCompleted, which are central to the application's functionality. The relationships define a flow of services from booking to completion, for example, appointments connect customers to the services they request and to the professionals who perform those services, while keeping track of the appointment time and priorities.

Additional entities like Payments, Reviews and Notifications bridge the gap between primary entities and provide extended functionality like payment tracking, customer feedback, and appointment alerts, respectively.

Many-to-many relationships between Appointments and Invoices is broken down to include an Associative entity named ServicesCompleted embodying the service delivery process. WorkEquipment and SuppliedUsed are there keep track of the equipment and inventory that professionals use to fulfill the services.

Overall, the database maintains the dynamic interactions that define the business processes of WorkD.

2.3. Transform EER Model to Relational Model: LucidChart
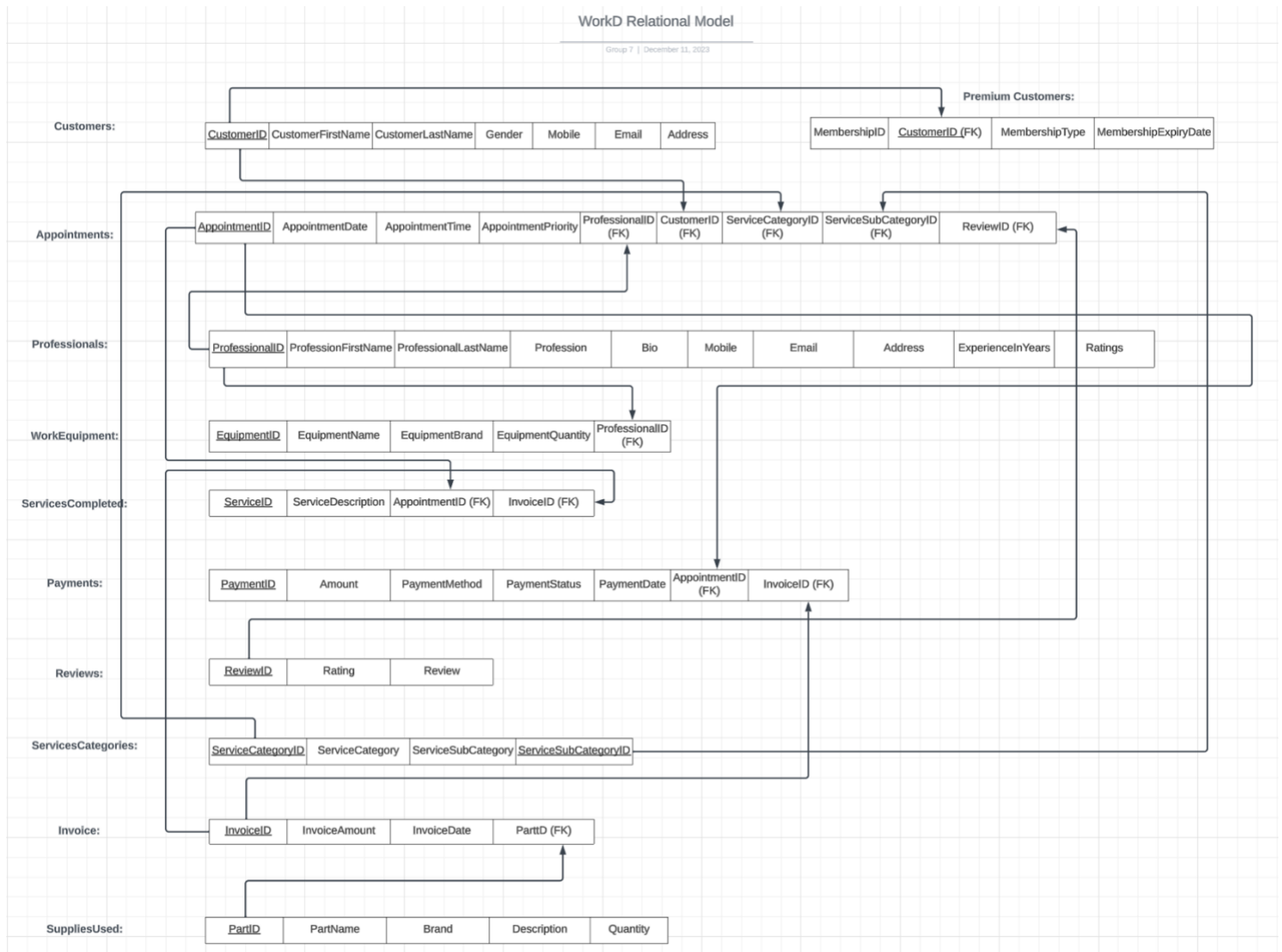
The Relational model for the "WorkD - Work at Your Doorstep" project illustrates a normalized database structure, adhering to the principles of the third normal form (3NF). It is meticulously designed to provide a robust and efficient framework for storing and managing the data associated with our 'Work at your Doorstep' services. At the core of our model are exceptionally well-defined entities such as Customers, Professionals, Appointments, Reviews, Payments, Invoices, Notifications, ServicesCompleted, ServiceCategories, SuppliesUsed, WorkEquipment, and PremiumCustomers. Each entity is represented by a table with a unique primary key (PK) ensuring the uniqueness of every record, and that our data is free from update anomalies.

The relationship between PremiumCustomers and Customers is handled through an overlapping subtype relationship, where PremiumCustomers inherits the primary key from the Customers table. This design ensures that additional attributes specific to premium customers are stored efficiently without redundancy.

Normalization to 3NF is evident in the separation of entities into distinct tables, such as 'Professionals', 'ServicesCategories', and 'WorkEquipment', each containing attributes specific to the entity and linking back to other tables only through foreign keys. The 'Payments' table illustrates the 3NF principles by storing payment details separately from appointments and services, connected only by keys, thus eliminating transitive dependencies. Similarly, the 'Reviews' and 'Notifications' tables are linked to the services and appointments they relate to, ensuring that no non-key attribute depends on another non-key attribute.

By conforming to 3NF, the relational model for WorkD ensures that the database is efficient for querying, resistant to anomalies, and flexible enough to handle changes in business requirements without the need for major restructuring.

3. Database Implementation

Using MySQL Workbench, the schema was constructed with precise data type definitions and constraints to guarantee the accuracy and consistency of the data. Tables were created for each entity, with primary keys assigned to enforce entity integrity and foreign keys defined to maintain referential integrity across the relational database.

The implementation phase involved setting up an Amazon RDS instance, which provides a scalable environment for the database with the benefits of cloud storage, such as high availability, security, and automated backups. Once the database was established in Amazon RDS, test data was inserted into each table to validate the relationships and constraints.

3.1. Create Tables and Dummy Data

Create table and dummy data scripts are attached along with the report.

Customers Table: The 'Customers' table begins with a 'CustomerID' as a primary key to ensure each customer has a unique identifier. VarChar types are used for names, gender, mobile, email, and address with specified character limits to accommodate various inputs while maintaining data consistency.

Professionals Table: Similarly, the 'Professionals' table includes a primary key and VarChar types, with an additional field for 'ExperienceInYears' to record the professional's experience length, essential for customer assurance of service quality.

Reviews Table: The 'Reviews' table uses a VarChar for the review text and a Decimal type for ratings, which allows for precise numerical feedback up to two decimal places, providing a standardized way to capture customer satisfaction.

SuppliesUsed Table: In the 'SuppliesUsed' table, 'PartID' serves as a primary key with additional descriptive fields and an integer quantity, which is crucial for inventory management.

WorkEquipment Table: The 'WorkEquipment' table includes a foreign key that references the 'Professionals' table, establishing a relationship between equipment and the professionals using them, facilitating resource tracking.

PremiumCustomers Table: The 'PremiumCustomers' table extends the 'Customers' table, including a foreign key to 'CustomerID'. The 'CHECK' constraint on 'MembershipType' ensures data validity by allowing only predefined membership types.

ServiceCategories Table: The 'ServiceCategories' table introduces a composite primary key to uniquely identify each service and subcategory, with 'CHECK' constraints that enforce the acceptance of only certain service categories.

Appointments Table: The 'Appointments' table includes multiple foreign keys to associate appointments with customers, professionals, reviews, and services, as well as 'CHECK' constraints on 'AppointmentPriority' to restrict it to defined values.

Invoice and Payments Tables: The 'Invoice' and 'Payments' tables link financial transactions to services and appointments. 'Payments' further include 'CHECK' constraints on 'PaymentMethod' and 'PaymentStatus' to limit entries to accepted values.

Notifications and ServicesCompleted Tables: Finally, the 'Notifications' table manages communication statuses with 'CHECK' constraints, and the 'ServicesCompleted' table ties services to appointments and invoices, ensuring that the database captures the entirety of the service lifecycle.

Note: All the business analytics questions and queries used for further visualizations are attached along with the report in a SQL file.

3.2. Business Analytics Questions

1. Revenue Analysis by Service Category

    Query:
    ```
    SELECT SC.ServiceCategory, SUM(I.InvoiceAmount) AS TotalRevenue
    FROM ServiceCategories SC
    JOIN Appointments A ON SC.ServiceCategoryID = A.ServiceCategoryID
    JOIN ServicesCompleted S ON A.AppointmentID= S.AppointmentID
    JOIN Invoice I ON S.InvoiceID = I.InvoiceID
    GROUP BY SC.ServiceCategory;
    ```

2. Average Rating for Each Professional

    Query:
    ```
    SELECT P.ProfessionalID, P.ProfessionalFirstName, P.ProfessionalLastName,
    AVG(R.Rating) AS AverageRating
    FROM Professionals P
    JOIN Appointments A ON P.ProfessionalID = A.ProfessionalID
    JOIN Reviews R ON A.ReviewID = R.ReviewID
    GROUP BY P.ProfessionalID, P.ProfessionalFirstName,
    P.ProfessionalLastName;
    ```

3. Appointment Count by Service Sub-Category

    Query:
    ```
    SELECT SC.ServiceSubCategory, COUNT(A.AppointmentID) AS AppointCount
    FROM ServiceCategories SC
    JOIN Appointments A ON SC.ServiceCategoryID = A.ServiceCategoryID AND
                SC.ServiceSubCategoryID = A.ServiceSubCategoryID
    GROUP BY SC.ServiceSubCategory;
    ```

4. Payment Method Distribution:

    Query:
    ```
    SELECT P.PaymentMethod, COUNT(P.PaymentID) AS PaymentCount
    FROM Payments P
    GROUP BY P.PaymentMethod;
    ```

5. Membership Type Distribution

Query: SELECT PC.MembershipType, COUNT(PC.MembershipID) AS MembershipCount

            FROM PremiumCustomers PC

            GROUP BY PC.MembershipType;

6. Top 5 Professionals by Total Revenue

Query: SELECT P.ProfessionalID, P.ProfessionalFirstName, P.ProfessionalLastName,

            SUM(I.InvoiceAmount) AS TotalRevenue

            FROM Professionals P

            JOIN WorkEquipment WE ON P.ProfessionalID = WE.ProfessionalID

            JOIN Invoice I ON WE.EquipmentID = I.PartID

            GROUP BY P.ProfessionalID, P.ProfessionalFirstName, P.ProfessionalLastName

            ORDER BY TotalRevenue DESC

            LIMIT 5;

7. Average Invoice Amount by Gender

Query: SELECT C.Gender, AVG(I.InvoiceAmount) AS AverageInvoiceAmount

            FROM Customers C

            JOIN Appointments A ON C.CustomerID = A.CustomerID

            JOIN ServicesCompleted S ON A.AppointmentID= S.AppointmentID

            JOIN Invoice I ON S.InvoiceID = I.InvoiceID

            GROUP BY C.Gender;

8. Total Quantity of Supplies Used by Equipment Brand

Query: SELECT WE.EquipmentBrand, SUM(SU.Quantity) AS TotalQuantityUsed

            FROM WorkEquipment WE

            JOIN SuppliesUsed SU ON WE.EquipmentID = SU.PartID

            GROUP BY WE.EquipmentBrand;

9. Appointment Status Distribution

Query: SELECT A.AppointmentPriority, COUNT(A.AppointmentID) AS AppointmentCount

FROM Appointments A

GROUP BY A.AppointmentPriority;

10. Professionals with Most Appointments

Query: SELECT P.ProfessionalID, P.ProfessionalFirstName, P.ProfessionalLastName,

COUNT(A.AppointmentID) AS AppointmentCount

FROM Professionals P

JOIN Appointments A ON P.ProfessionalID = A.ProfessionalID

GROUP BY P.ProfessionalID, P.ProfessionalFirstName, P.ProfessionalLastName

ORDER BY AppointmentCount DESC

LIMIT 5;

11. Average Rating by Service Category

Query: SELECT SC.ServiceCategory, AVG(R.Rating) AS AverageRating

FROM ServiceCategories SC

JOIN Appointments A ON SC.ServiceCategoryID = A.ServiceCategoryID

JOIN Reviews R ON A.ReviewID = R.ReviewID

GROUP BY SC.ServiceCategory;

12. Top 3 Service Sub-Categories by Appointment Count

Query: SELECT SC.ServiceSubCategory, COUNT(A.AppointmentID) AS AppointmentCount

FROM ServiceCategories SC

JOIN Appointments A ON SC.ServiceCategoryID = A.ServiceCategoryID AND SC.ServiceSubCategoryID = A.ServiceSubCategoryID

GROUP BY SC.ServiceSubCategory

ORDER BY AppointmentCount DESC LIMIT 3;

13. Pending Payments by Payment Method

Query: SELECT P.PaymentMethod, COUNT(P.PaymentID) AS PendingPaymentCount

FROM Payments P

WHERE P.PaymentStatus = 'Pending'

GROUP BY P.PaymentMethod;

Note: All these business analytics questions and queries used for visualizations are attached along with the report in a SQL file.

4. Deploy Database on AWS Cloud

The database has been created on Amazon RDS Service, using My SQL Workbench.

4.1. AWS DB Information

Hostname: mis686-term-project.cqm1usp6uipa.us-west-1.rds.amazonaws.com
user: admin
PW: termproject7mis686

5. App Database Interaction

Visualizations/Analytics on WorkD using its database has been published on Tableau Public. link.
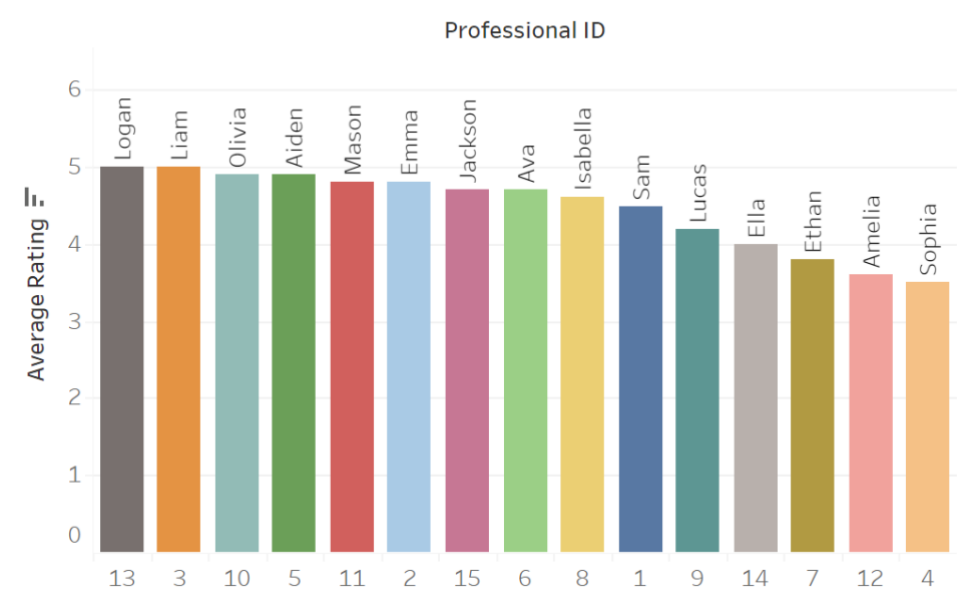

Average Rating by Service Category

This visualization is the Average Rating by Service Category. The four service categories are Beauty salon, Electrical Repair, Home Maintenance, and Plumbing. This chart would be important for the company because it reflects customer satisfaction across different service categories. High ratings might indicate areas where the company excels, while lower ratings could reveal opportunities for training, quality improvement, or operational changes.
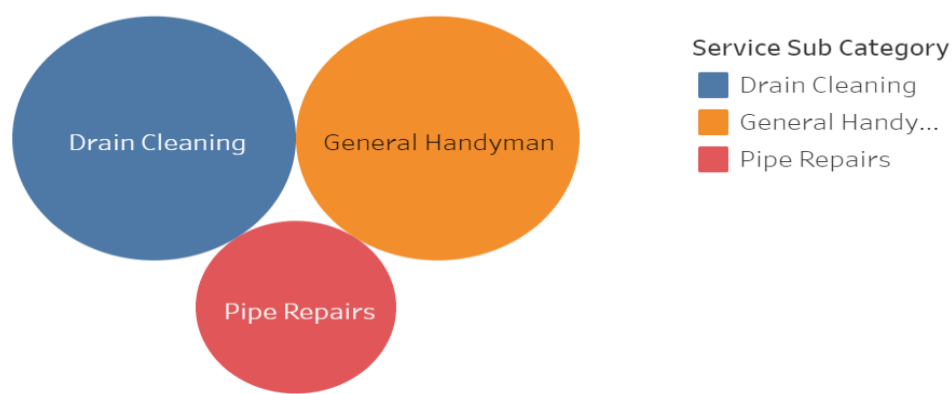

This visualization depicts the Top 3 Service Subcategories by Appointment. These three are drain cleaning, general handyman, and pipe repairs. This type of visualization can help WorkD identify any potential overlap in subcategories which can then be better consolidated. It can also show the type of work that is most needed by consumers which would then show WorkD that more professionals of that category should be hired to handle the demand.

This visualization is of the Top 15 Professionals by Average Rating. Each Professional's average rating is depicted along with the Professional's last name and average rating. This would be important to a user because most users want to ensure the person that they are going to be hiring has a good track record and is known for good work. It also helps professionals strive to provide excellent service because a professional with high average ratings is more likely to get booked.

Membership Distribution
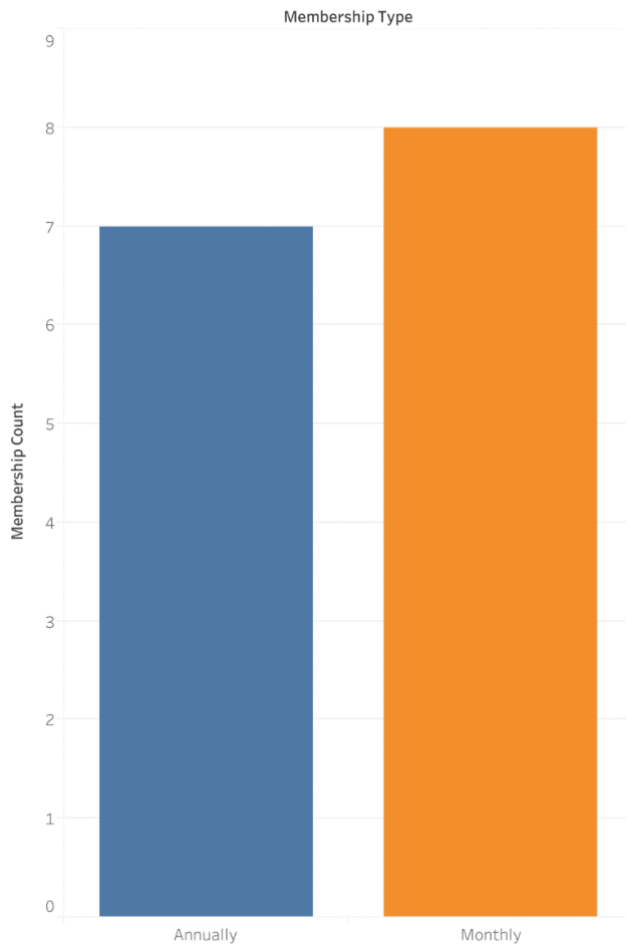
This bar chart shows the distribution of Memberships for WorkD. There are annual and monthly membership types. There are currently more monthly subscriptions than there are annual memberships. This type of visualization is important for analyzing WorkD as it can help with revenue forecasting and can help predict cash flow and help plan financial strategies. The chart can also help tailor marketing efforts to boost sales of the less popular type or also capitalize on the popularity of the more common one.

Appointment Count by Service Sub Category
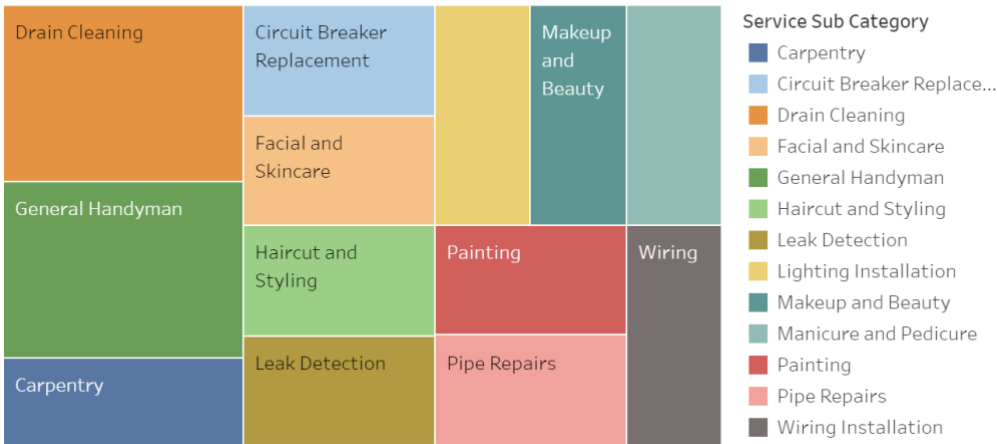
This visualization is of Appointment Counts by Service Subcategory. It shows various service subcategories such as Drain Cleaning, Circuit Breaker Replacement, Facial and Skincare, General Handyman, Carpentry, Haircut and Styling, Leak Detection, Painting, Pipe Repairs, and Wiring Installation. This type of visualization can help the company identify which services are most in demand. This can help seek more professionals for that type of work. This will help allocate resources efficiently. The distribution of appointments can inform strategic decisions related to service offerings, expansion, or discontinuation of less popular services.

Top 5 Professionals by Revenue
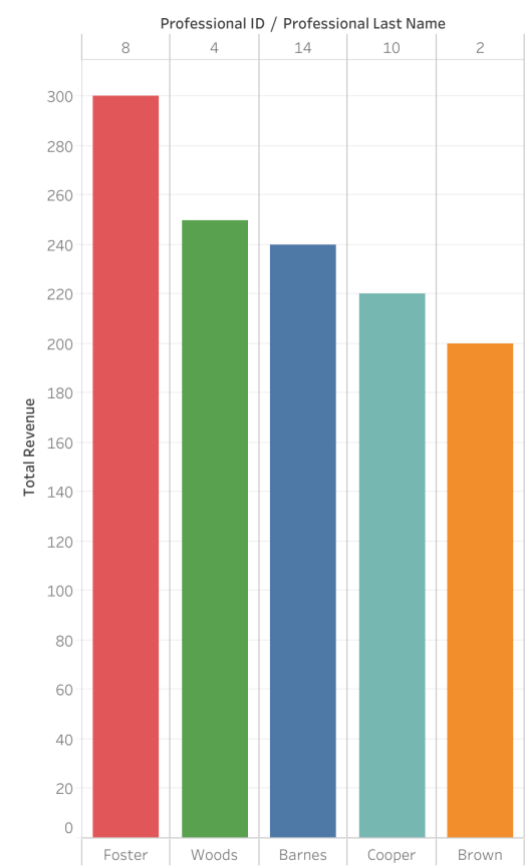
This visualization depicts the Top 5 Professionals by Revenue. This visualization would be important to the company because it helps identify which professionals are generating the most revenue. This can allow the company to allocate support and resources more effectively by investing in the high earners or even providing more support for those earning less to help improve their performance and the revenue the company earns as well. Understanding revenue generation can help in developing a fair and motivating compensation and incentive structure.

6. Conclusion and Future Improvements

In conclusion, the "WorkD - Work at Your Doorstep" project's database model serves as a foundational framework, underpinning the essential operations of connecting customers with professional services. The current model successfully encapsulates the core business entities and their interactions, providing a reliable and structured platform from which to launch the enterprise's digital presence. However, this database model is just the beginning. Future improvements will focus on the development and integration of triggers and stored procedures to automate daily appointments, transactions, and other routine tasks. These database objects will play a crucial role in enhancing the efficiency and responsiveness of the system, reducing the need for manual intervention, and ensuring the accuracy of data processing.

Furthermore, as WorkD evolves, the database will be designed to accommodate growth and changes in business processes. This includes the potential to integrate more sophisticated analytics for business intelligence, the incorporation of artificial intelligence to predict service trends, and enhanced security measures to safeguard user data. The flexibility of the current model is such that it allows for the seamless introduction of additional processes as required. Whether it is expanding the range of services offered, supporting a larger user base, or adapting to changes in the regulatory landscape, the database can be scaled and modified to meet these needs. In essence, the WorkD database is poised not only to meet the current demands of the service industry but also to adapt and flourish amidst the inevitable technological advancements and market dynamics of the future.