

## **Section I: Cover Page**

Real Estate Property Management System

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### **Section III: Project Description**

The motivation for creating this database system for real estate property management is having worked with many investors during my time as a realtor, there are many factors to consider when acquiring a property. This includes maintenance, the existing tenants, future tenants, and any equity plays in progress. Aspiring investors may often lose sight of other variables by zooming in on one, such as cash flow, which can lead to a loss in factoring in equity plays or varying initial investments due to required rehabilitation. This database system aims to enhance the investor's view and reduce the struggle to strategize by consolidating and storing info on these different variables in a singular database for investors and property managers to keep track of their investments.

The database system will function by storing data on each property's current status regarding tenants and needed maintenance. In addition, a unique feature of this database is to couple this with additional data: for investors who are interested in home-flipping or refinancing strategies to grow their portfolios, equity plays will be encouraged by storing entry purchase prices and target after-rehab values. This works to account for projects in progress - relevant values, IE rehab costs, will also be included in the database. Because strong cash-flow continues to become scarcer in high ticket areas such as the Bay Area or Seattle, it's important to create a shift in how investments are perceived - this organization of data allows investors to factor in both rental income and equity.

ManageCasa and Buildium are two property management software tools that would benefit from this because they focus more on simple accounting, tenant management, and maintenance management, but do not track ongoing projects. They would benefit from using this database to provide investors with the tools needed to support equity oriented strategies as well as manage ongoing accounting and maintenance.

1. **Use case:** Decide whether to sell or keep a property (using past expenditures and expected ARV)

**Actor:** Owner of properties (John)

**Description:** John owns 3 properties, and has been having trouble with one of the tenants for the last year since he purchased his most recent property. The tenant is constantly texting him all day and night with various requests for maintenance. The stress has been making him consider if he should keep the property. By using the Real Estate Property Management Database System, he looks up the records of the property and finds that the tenant has always paid their rent on time. In addition, the property is his top performer in terms of rental income cash flow. As he's pulling data on the property, he notices the after repair value that he targeted when he first purchased the property, which was a whopping 30% higher than the entry level. As a result, he decides to hire a property manager to eliminate direct contact with the tenant, and pour more money into the rehab of the property to raise its value to the target after-rehab value.

2. **Use case:** Evicting a tenant

**Actor:** Owner of properties (Alex), Property manager (Jess), Tenant (Sarah)

**Description:** Jess is managing a number of properties for Alex, and has been struggling with a tenant, Sarah, who refuses to stop smoking inside the property. Sarah also makes excessive noise during quiet hours. Because of her habits, tenants keep terminating their leases because sharing a wall with Sarah is unpleasant due to the smell and noise. Jess needs to build a case to convince Alex that an eviction is worth the effort here, because Alex doesn't know how troublesome this tenant has been. Using the Real Estate Property Management Database System, Jess is able to pull Sarah's lease which explicitly states that smoking in the unit is grounds for termination of the lease, as well as a consistent record of delinquent rent payments. In addition, Jess also pulls a series of notes of every time Sarah has been given notice to cease smoking indoors. Lastly, because Sarah has been in the unit for 7 years, the unit is very outdated, so if it's vacant, the value of the property can be increased via rehab for a higher refinance amount. Armed with a starter pack of evidence to support Sarah's eviction, Jess sends the data to Alex to persuade him that it's worth the investment for a stable and lucrative property.

3. **Use case:** Accounting to determine when next property can be purchased

**Actor:** Owner of properties (Liz), Accountant (Eric)

**Description:** Liz is eager to grow her portfolio from its current state of 3 properties and 10 units, but has no liquidity. She does not want to sell any properties, and is not savvy when it comes to different ways of purchasing a property without having cash in hand. She contacts Eric, her accountant, and asks him when she'll be able to buy her next property. Eric pulls the net cash flow on each property and totals them to get a total number of \$5k income per month. For her target purchase price of \$1m, she would need to wait 40 months for the cash flow to cover a 20% down payment, not accounting for closing costs. Eric finds that she hadn't refinanced on any of her properties for the last 5 years and is likely sitting on a substantial amount of equity. He recommends to her that she refinance on one of her properties in order to enter the market within a couple of months, rather than wait 3-4 years for her next acquisition.

## **Section IV: Functional Database Requirements**

1. Users
  - 1.1 A user shall create at most one account
  - 1.2 A user shall have a unique tracking id
  - 1.3 A user, without an account, shall not be able to view a portfolio
2. RegisteredUsers
  - 2.1 A registered user is also a user
  - 2.2 A registered user shall have a password
  - 2.3 A registered user shall have a portfolio
  - 2.4 A registered user shall have at most one unique email
  - 2.5 A registered user shall have a first name
  - 2.6 A registered user shall have a last name
  - 2.7 A registered user shall have a full name
  - 2.8 A registered user shall have a tracking id
3. Portfolios
  - 3.1 A portfolio shall have many properties
  - 3.4 A portfolio shall have a unique id
  - 3.5 A portfolio shall have a number of properties
  - 3.6 A portfolio shall have a last appraised value
  - 3.7 A portfolio shall belong to at least one registered user
4. Properties
  - 4.1 A property shall have at least one address
  - 4.2 A property shall have many tenants
  - 4.3 A property shall have a quantity of units
  - 4.4 A property shall have a total rental income
  - 4.5 A property shall have a monthly capital expenditures amount
  - 4.6 A property shall have a property history
  - 4.7 A property shall have a bedroom count
  - 4.8 A property shall have a bathroom count
  - 4.9 A property shall have a square footage size
  - 4.10 A property shall have a lot size
  - 4.11 A property shall have a target after rehab value
  - 4.12 A property shall have a project info
  - 4.13 A property shall have units
  - 4.14 A property shall have a property type
  - 4.15 A property shall belong to at least one portfolio

4.16 A property shall have a unique id

5. Addresses

- 5.1 An address shall have one number
- 5.2 An address shall have one street name
- 5.3 An address shall have a city
- 5.4 An address shall have a state/province
- 5.5 An address shall have a country
- 5.7 An address shall have a unique id
- 5.8 An address shall have a numbered street

6. Tenants

- 6.1 A tenant shall have a first name
- 6.2 A tenant shall have a last name
- 6.3 A tenant shall have a full name
- 6.4 A tenant shall have a lease agreement
- 6.7 A tenant shall have a payment history
- 6.9 A tenant shall belong to a unit
- 6.10 A tenant shall have a notes field
- 6.11 A tenant shall have a unique id

7. PropertyHistories

- 7.1 A propertyhistory shall have a purchase date
- 7.2 A propertyhistory shall have a purchase amount
- 7.3 A propertyhistory shall have a maintenance notes text field
- 7.4 A propertyhistory shall have a last appraised value
- 7.6 A propertyhistory shall have many expense histories
- 7.7 A propertyhistory shall have inspection records
- 7.8 A propertyhistory shall have a unique id

8. Units

- 8.1 A unit shall have a bedroom count
- 8.2 A unit shall have a bathroom count
- 8.3 A unit shall have a rent
- 8.4 A unit shall have many tenants
- 8.5 A unit shall be vacant or occupied
- 8.6 A unit shall belong to a property
- 8.7 A unit shall have a payment history
- 8.8 A unit shall have a unique id
- 8.9 A unit shall have a building number

9. PaymentHistories

- 9.1 A paymenthistory shall belong to a tenant

- 9.2 A paymenthistory shall belong to a unit
- 9.3 A paymenthistory shall have a unique id
- 9.5 A paymenthistory shall have an amount
- 9.6 A paymenthistory shall have a paid date
- 9.9 A paymenthistory shall have a due date

## 10. ExpenseHistories

- 10.1 An expensehistory shall have a label
- 10.2 An expensehistory shall have a cost
- 10.3 An expensehistory shall have a date
- 10.4 An expensehistory shall belong to a propertyhistory
- 10.6 An expensehistory shall have a unique id

## 11. ProjectInfos

- 11.1 A projectinfo shall belong to a property
- 11.2 A projectinfo shall have a project title
- 11.3 A projectinfo shall have a project description
- 11.4 A projectinfo shall have an in progress flag
- 11.6 A projectinfo shall have a unique id
- 11.7 A projectinfo shall have many projectupdates
- 11.8 A projectinfo shall have zero or many contractors

## 12. InsurancePolicies

- 12.1 An insurancepolicy shall belong to a property
- 12.2 An insurancepolicy shall have a policy number
- 12.3 An insurancepolicy shall have a provider
- 12.4 An insurancepolicy shall have a monthly cost
- 12.5 An insurancepolicy shall have a start date
- 12.6 An insurancepolicy shall have an end date
- 12.7 An insurancepolicy shall have a unique id

## 13. Contractors

- 13.1 A contractor shall have a unique id
- 13.2 A contractor shall have a company name
- 13.3 A contractor shall have a first name
- 13.4 A contractor shall have a last name
- 13.5 A contractor shall have a full name
- 13.6 A contractor shall have a services field

## 14. InspectionRecords

- 14.1 An inspectionrecord shall belong to a propertyhistory
- 14.2 An inspectionrecord shall have a unique id
- 14.3 An inspectionrecord shall have an inspector name

14.4 An inspectionrecord shall have a notes

15. LeaseAgreements

- 15.1 A leaseagreement shall belong to many tenants
- 15.2 A leaseagreement shall have a unique id
- 15.3 A leaseagreement shall have a start date
- 15.4 A leaseagreement shall have an end date
- 15.5 A leaseagreement shall have many tenants
- 15.6 A leaseagreement shall have a terms field
- 15.7 A leaseagreement shall have a property id
- 15.8 A leaseagreement shall have a rent

16. TenantLeaseAgreements (Associative)

- 16.1 A tenantleaseagreement shall have a tenant
- 16.2 A tenantleaseagreement shall have a leaseagreement
- 16.3 A tenantleaseagreement shall have a unique id tracker
- 16.4 A tenantleaseagreement shall have a tenant name

17. TaxRecords

- 17.1 A taxrecord shall have a unique id
- 17.2 A taxrecord shall have a year
- 17.3 A taxrecord shall have an amount due
- 17.4 A taxrecord shall have an amount paid
- 17.5 A taxrecord shall have a due date
- 17.6 A taxrecord shall have a payment date
- 17.7 A taxrecord shall have a property id
- 17.8 A taxrecord shall belong to a property

18. Mortgages

- 18.1 A mortgage shall have a unique id
- 18.2 A mortgage shall have a lender name
- 18.3 A mortgage shall have a loan principal balance
- 18.4 A mortgage shall have an interest rate
- 18.5 A mortgage shall have a total monthly payment
- 18.6 A mortgage shall have a start date
- 18.7 A mortgage shall have an end date
- 18.8 A mortgage shall have a property id
- 18.9 A mortgage shall have a terms

19. UserPortfolios

- 19.1 A UserPortfolio shall have a RegisteredUser
- 19.2 A UserPortfolio shall have a Portfolio
- 19.3 A UserPortfolio shall have a tracking id
- 19.4 A UserPortfolio shall have a last appraised value

20. ProjectUpdates

- 21.1 A projectupdate shall belong to a projectinfo
- 21.2 A projectupdate shall have a date
- 21.3 A projectupdate shall have an update text field
- 21.4 A projectupdate shall have a unique tracking ID

21. ProjectContractors

- 22.1 A projectcontractor shall belong to a projectinfo
- 22.2 A projectcontractor shall have a contractor
- 22.3 A projectcontractor shall have a tracking id
- 22.4 A projectcontractor shall have a services field

22. Roles

- 23.1 A role for a registered user shall be an admin
- 23.2 A role for a registered user shall be an owner
- 23.3 A role shall have a role id

23. ProjectInfoUpdates

- 24.1 A projectinfoupdate shall have a projectinfo
- 24.2 A projectinfoupdate shall have a projectupdate
- 24.3 A projectinfoupdate shall have a date
- 24.4 A projectinfoupdate shall have a project title

24. UnitTenants

- 25.1 A unittenant shall have a unit
- 25.2 A unittenant shall have a tenant
- 25.3 A unittenant shall reference a numbered street
- 25.4 A unittenant shall have a tenant name

25. PortfolioProperties

- 26.1 A portfolioproperty shall have a portfolio
- 26.2 A portfolioproperty shall have a property
- 26.3 A portfolioproperty shall have a property's rent

26. UnitPaymentHistories

- 27.1 A unitpaymenthistory shall have a unit
- 27.2 A unitpaymenthistory shall have a paymenthistory
- 27.3 A unitpaymenthistory shall have a paid date
- 27.4 A unitpaymenthistory shall have a building number
- 27.5 A unitpaymenthistory shall have an amount

27. TenantPaymentHistories

- 28.1 A tenantpaymenthistory shall have a tenant

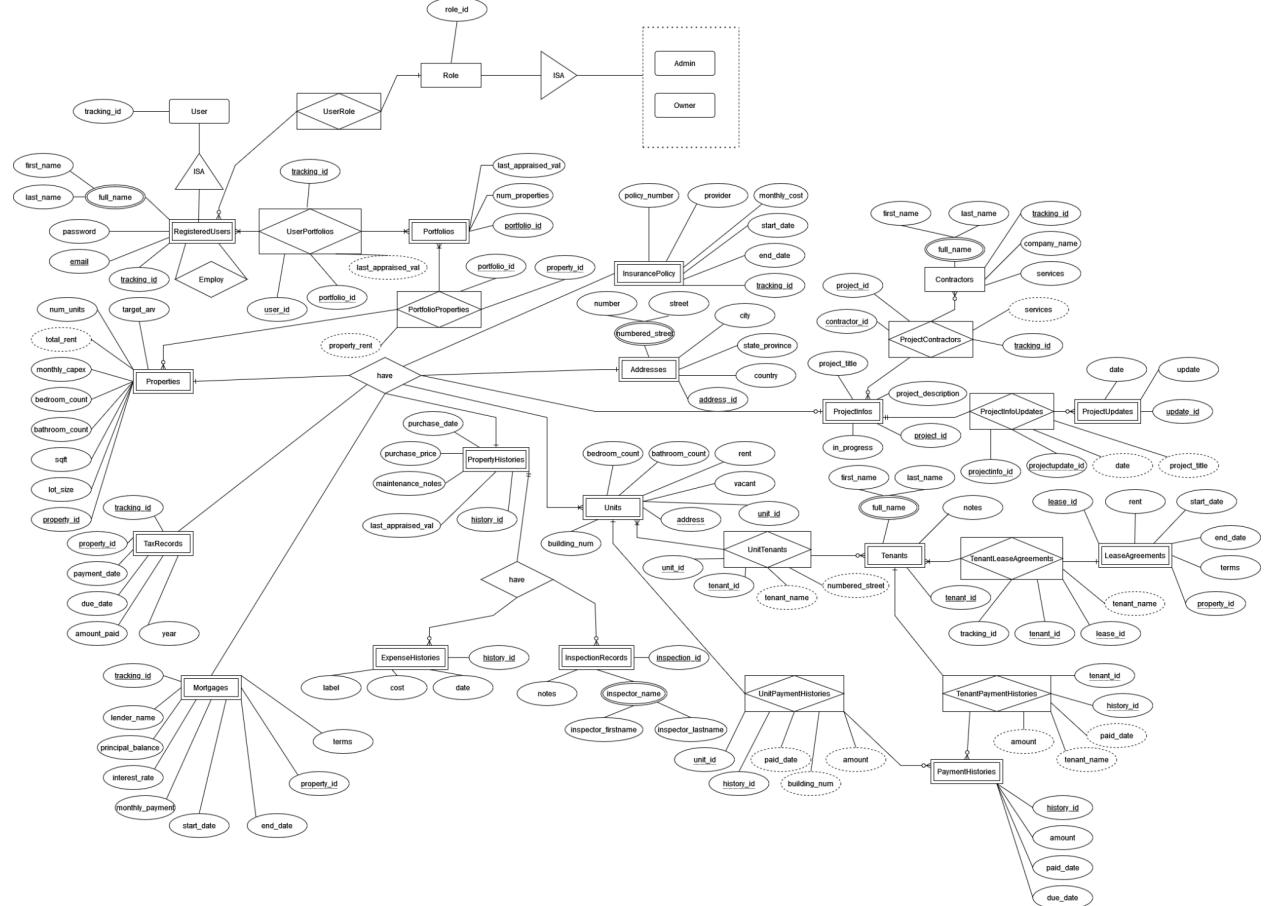
- 27.2 A tenantpaymenthistory shall have a paymenthistory
- 27.3 A tenantpaymenthistory shall have a paid date
- 27.4 A unitpaymenthistory shall have a tenant name
- 27.5 A unitpaymenthistory shall have an amount

## **Section V: Non-functional Database Requirements**

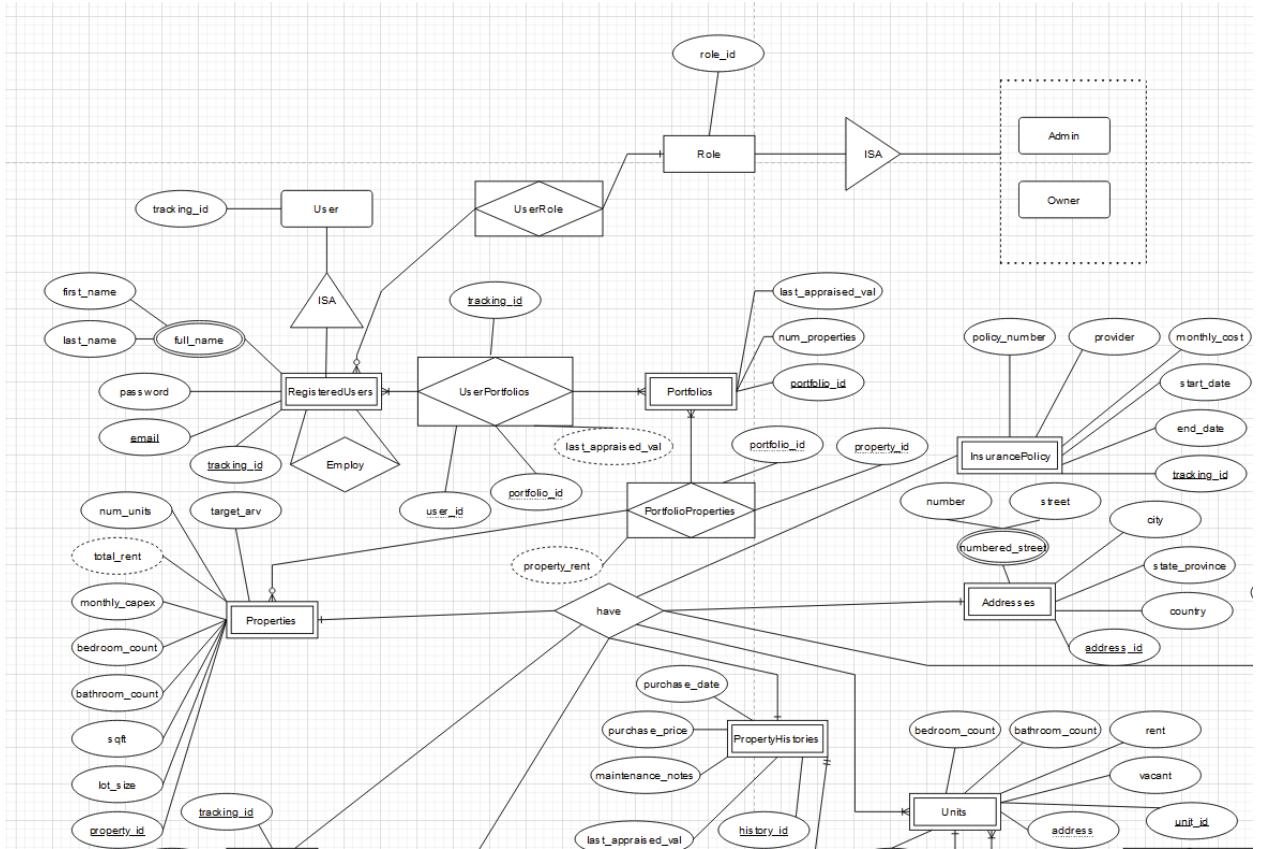
1. Performance
  - 1.1 The database shall return data in under 3 seconds for 95% of the queries
  - 1.2 The database shall use indexes to minimize query execution time and prevent degradation as data size increases
  - 1.3 The system shall process bulk data of 1000 records or more in under 5 minutes
2. Security
  - 2.1 All sensitive data, including passwords and financial info, shall be encrypted with AES encryption
  - 2.2 Access to the database shall be restricted based on user privileges
  - 2.3 The system shall implement measures such as input validation to prevent SQL injection
3. Scalability
  - 3.1 The database system shall support the addition of new database instances by load balancing to accommodate increased data volume without disrupting service as needed
  - 3.2 The database system shall incorporate load balancing to distribute query traffic across servers as needed
  - 3.3 The database system shall support at least 1000 concurrent connections
4. Capability
  - 4.1 The database system shall support real-time synchronization so that changes are instantly reflected to all users
  - 4.2 The database system shall manage concurrent data access and updates correctly by using mechanisms like locking to avoid race conditions
  - 4.3 Users shall be able to export and import data in CSV, XML, and JSON formats
5. Environmental
  - 5.1 The database system shall be optimized to minimize power consumption
  - 5.2 The database system shall support methods of recovery in case of environmental disaster
  - 5.3 The database system shall use data centers and technology that are environmentally regulated
6. Coding Standard
  - 6.1 The database system shall use camelCase for all fields and plural names for all tables
  - 6.2 All code shall have supportive documentation, such as a README, or comments
  - 6.3 All database changes shall be managed in a version control system
7. Storage
  - 7.1 The database shall assign 10 MB of memory per tables

- 7.2 The database system shall support persistent storage
- 7.3 The database system shall be able to be backed up in case of emergencies
- 8. Privacy
  - 8.1 Sensitive information such as passwords and financial info shall be protected from being displayed to users who don't have sufficient privileges
  - 8.2 The system shall log whenever personal data is accessed or modified and by whom
  - 8.3 Tenant information shall only be viewable by users with permission

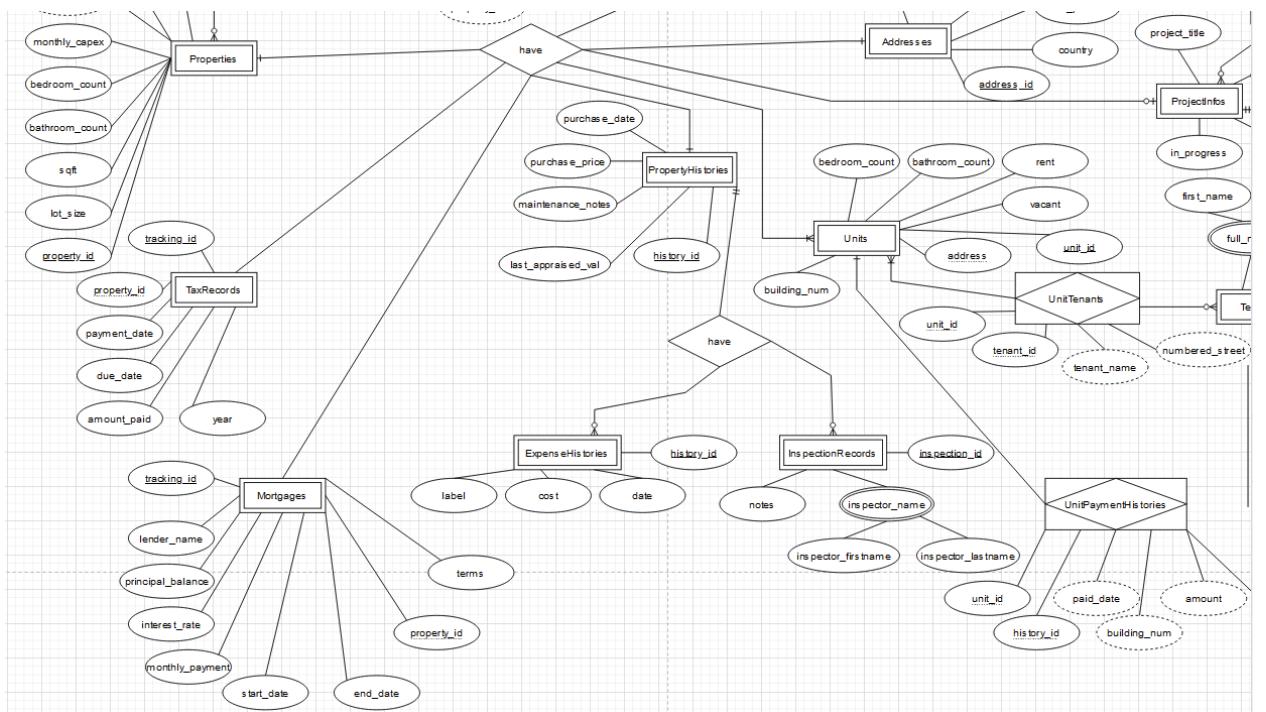
## Section VI: Entity Relationship Diagram (ERD)



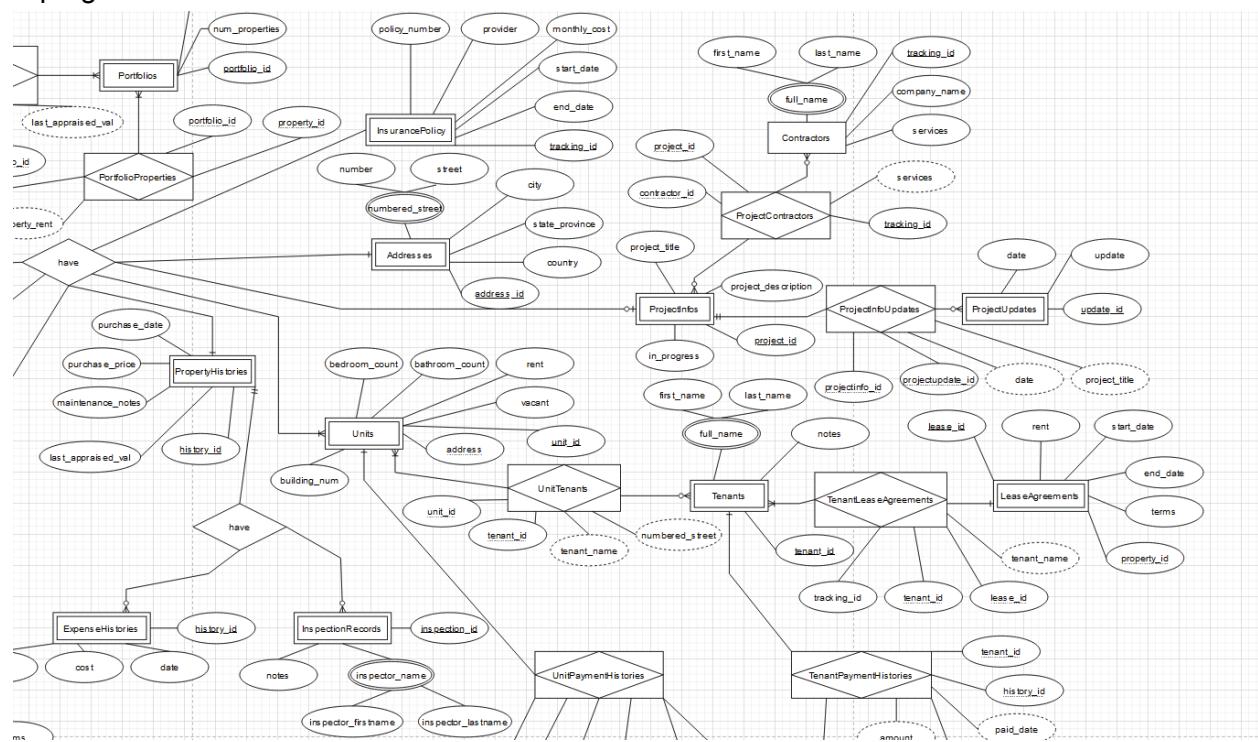
Top left:



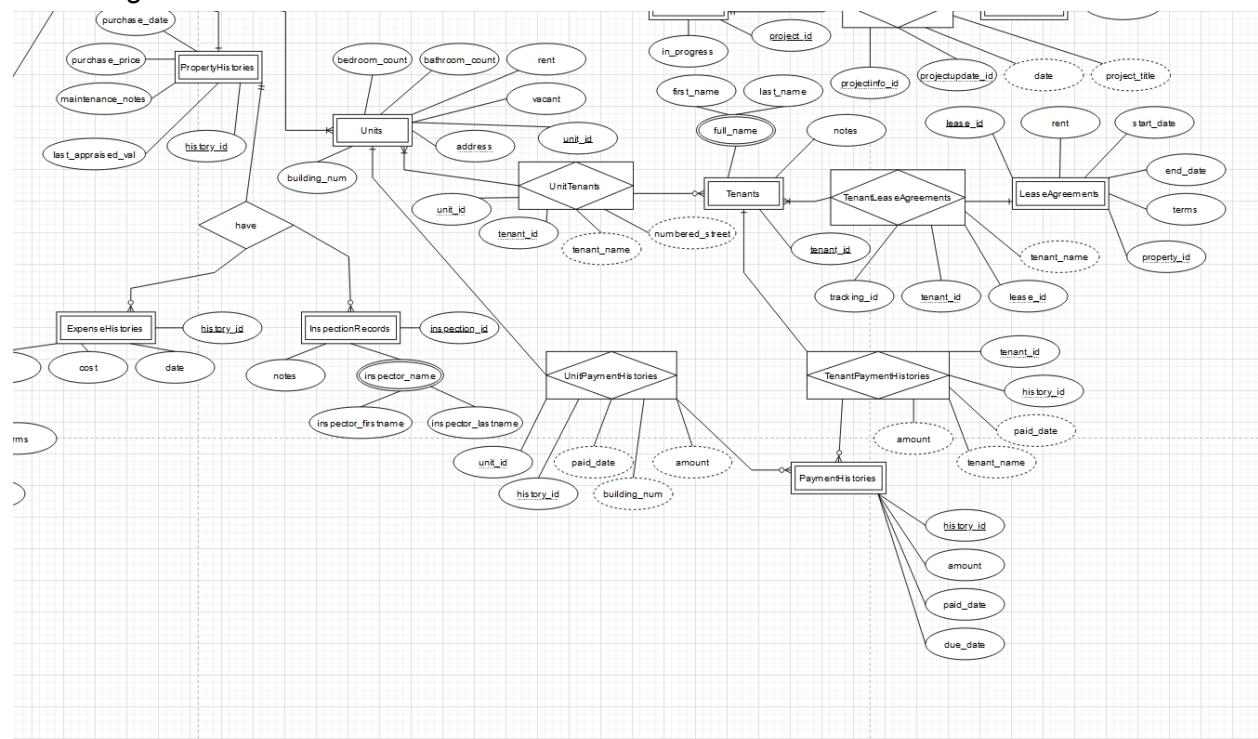
Bottom left:



## Top right:



## Bottom right:



## Section VII: Entity Set Description

1. Users (Strong)
  - tracking\_id: strong key, numeric
2. RegisteredUsers (Weak)
  - full\_name: alphanumeric, autogenerated
  - first\_name: alphanumeric
  - last\_name: alphanumeric
  - password: alphanumeric
  - email: alphanumeric, composite primary key
  - tracking\_id: numeric, composite primary key
3. Portfolios (Weak)
  - last\_appraised\_val: numeric
  - num\_properties: numeric
  - portfolio\_id: numeric, primary key
4. Properties (Weak)
  - target\_arv: numeric
  - num\_units: numeric
  - total\_rent: numeric, derived
  - monthly\_capex: numeric
  - bedroom\_count: numeric
  - bathroom\_count: numeric
  - sqft: numeric
  - lot\_size: numeric
  - property\_id: numeric, primary key
5. Addresses (Weak)
  - numbered\_street: alphanumeric, autogenerated
  - number: numeric
  - city: alphanumeric
  - state\_province: alphanumeric
  - country: alphanumeric
  - address\_id: numeric, primary key
6. Tenants (Weak)
  - full\_name: alphanumeric, autogenerated
  - first\_name: alphanumeric
  - last\_name: alphanumeric
  - notes: alphanumeric
  - tenant\_id: numeric, primary key

7. PropertyHistories (Weak)

- purchase\_date: date, composite
- purchase\_price: numeric
- maintenance\_notes: alphanumeric
- last\_appraised\_val: numeric
- history\_id: numeric, primary key

8. Units (Weak)

- bedroom\_count: numeric
- bathroom\_count: numeric
- rent: numeric
- vacant: tinyint (boolean)
- unit\_id: numeric, primary key
- address: numeric, foreign key (references the Addresses entity set)
- building\_num: numeric

9. PaymentHistories (Weak)

- history\_id: numeric, primary key
- amount: numeric
- paid\_date: date, composite
- due\_date: date, composite

10. ExpenseHistories (Weak)

- history\_id: numeric, primary key
- cost: numeric
- date: date, composite
- label: alphanumeric

11. ProjectInfos (Weak)

- project\_title: alphanumeric
- project\_description: alphanumeric
- project\_id: numeric, primary key
- in\_progress: tinyint (boolean)

12. InsurancePolicies (Weak)

- policy\_number: numeric
- provider: alphanumeric
- monthly\_cost: numeric
- start\_date: date, composite
- end\_date: date, composite
- tracking\_id: numeric, primary key

13. Contractors (Strong)

- full\_name: alphanumeric, autogenerated
- first\_name: alphanumeric
- last\_name: alphanumeric
- tracking\_id: numeric, primary key
- company\_name: alphanumeric
- services: alphanumeric

14. InspectionRecords (Weak)

- inspection\_id: numeric, primary key
- inspector\_name: alphanumeric, autogenerated
- inspector\_firstname: alphanumeric
- inspector\_lastname: alphanumeric
- notes: alphanumeric

15. LeaseAgreements (Weak)

- lease\_id: numeric, primary key
- rent: numeric
- start\_date: date, composite
- end\_date: date, composite
- terms: alphanumeric
- property\_id: numeric, foreign key (references Properties entity set)

16. TenantLeaseAgreements (Associative)

- tracking\_id: numeric, primary key
- tenant\_id: numeric, composite primary key and foreign key (references Tenants entity set)
- lease\_id: numeric, foreign key (references LeaseAgreements entity set)
- tenant\_name: alphanumeric, derived

17. TaxRecords (Weak)

- tracking\_id: numeric, primary key
- property\_id: numeric, foreign key (references Properties entity set)
- payment\_date: date, composite
- due\_date: date, composite
- amount\_paid: numeric
- year: numeric

18. Mortgages (Weak)

- tracking\_id: numeric, primary key
- lender\_name: alphanumeric
- principal\_balance: numeric
- interest\_rate: numeric

- monthly\_payment: numeric
- start\_date: date, composite
- end\_date: date, composite
- property\_id: numeric, foreign key (references Properties entity set)
- terms: alphanumeric

19. UserPortfolios (Associative)

- tracking\_id: numeric, primary key
- last\_appraised\_val: numeric, derived
- portfolio\_id: numeric, composite primary key and foreign key (references Portfolios entity set)
- user\_id: numeric, composite primary key and foreign key (references RegisteredUsers entity set)

20. ProjectUpdates (Weak)

- date: date, composite
- update: alphanumeric
- update\_id: numeric, primary key

21. ProjectContractors (Associative)

- project\_id: numeric, composite primary key and foreign key (references ProjectInfos entity set)
- contractor\_id: numeric, composite primary key and foreign key (references Contractors entity set)
- services: alphanumeric, derived
- tracking\_id: numeric, primary key

**22. Roles**

- **role\_id: numeric?**

23. ProjectInfoUpdates (Associative)

- projectinfo\_id: numeric, composite primary key and foreign key (references ProjectInfos entity set)
- projectupdate\_id: numeric, composite primary key and foreign key (references ProjectUpdates entity set)
- date: date, derived
- project\_title: alphanumeric, derived

24. UnitTenants (Associative)

- unit\_id: numeric, composite primary key and foreign key (references Units entity set)
- tenant\_id: numeric, composite primary key and foreign key (References Tenants entity set)
- tenant\_name: alphanumeric, derived

- numbered\_street: alphanumeric, derived

25. PortfolioProperty (Associative)

- portfolio\_id: numeric, composite primary key and foreign key (references Portfolios entity set)
- property\_id: numeric, composite primary key and foreign key (references Properties entity set)
- property\_rent: numeric, derived

26. UnitPaymentHistories (Associative)

- unit\_id: numeric, composite primary key and foreign key (references Units entity set)
- history\_id: numeric, composite primary key and foreign key (references PaymentHistories entity set)
- paid\_date: derived
- building\_num: derived
- amount: derived

27. TenantPaymentHistories (Associative)

- tenant\_id: numeric, composite primary key and foreign key (references Tenants entity set)
- history\_id: numeric, composite primary key and foreign key (references PaymentHistories entity set)
- paid\_date: derived
- tenant\_name: derived
- amount: derived