Ulices Gonzalez

Public Library Catalog System

Student ID: 923328897

Github User: ulicessgg

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Project Description

As both a student and someone who feels strongly about the accessibility of information I believe that libraries are invaluable resources that can help educate us and provide us with various resources that can make a difference in our lives. I am a library worker and have been working at my local library for the past 3 years and over time I've seen the impact the resources we've provided the community has made. Having had experience for such a long time with my local library system I've seen the capabilities and the limitations the library can have which is why I intend to create a database that can address these. With any publicly available resource, there come issues when it grows in scale, specifically with the library it can lead to the mismanagement of items and user information that can negatively impact both the library and patrons alike. The most common issue I've seen is items appearing on patrons' accounts even after they've been checked in, deleted, and sometimes even paid for if they were fined. This leads to many difficult conversations and has led to these patrons no longer using the library. The unfortunate aspect is that it affects low-income patrons, teachers, and mostly children granted their Library card.

To address these issues I'd like to design my database to diversify the types of accounts available to users, rather than having a singular account classification. There should be many depending on the situation. Currently, a lot of libraries offer welcome cards which are available to any Patron so long as they can provide contact information but have limitations placed on them for the same reason that they lack other information that can verify their identity if and when they need to be contacted. I am similarly adapting this by having specific types of accounts based on age, use, institutional affiliation, and personal circumstances. This will be a vast improvement upon the pre-existing Library systems Foundation-wide since most children will

have the same accessibility as adults and even institutional cards for teachers even though they should have limitations based on them to protect them and their families from having to pay needless fines. Personal circumstances can also be a factor in the way people use libraries because not everyone will have a stable housing situation or the means to come to the library physically which by having as a consideration will increase the accessibility of library resources. By creating this database in the manner described it can then be adapted to any County library system meaning that interlibrary loans will be much easier to manage and will make it possible for patrons to check out and return materials regardless of their registration within that County so long as they have some form of library affiliation.

As of right now, the two most commonly used services within Library systems are Carl X for internal transactions and Millennium which is now being phased out by Sierra for external transactions. Due to these Services being split up, it can cause various issues when it comes to interlibrary loans from one County to another leading to patrons being fined massive amounts for something that is potentially an error due to the software. The other issue is that because these software Solutions rely on Library systems having an already established database they often carry over outdated information which can sometimes result in decades-old transactions still appearing on someone's account. Using my database will allow software solutions such as Sierra and Carl X to work together seamlessly without any information you need to input manually or any conflicts due to potential differences in classifications and data fields.

Lastly, when thinking of use cases for the database the following three were the ones I had in mind to effectively display the use of the database model. Teachers placing holds and checking items out will be able to have priority for item holds, and extended loan periods, and the responsibility for the items will be on their institution. Children will have most of the same

access as a full-service card but their cards will be linked to that of their parents to ensure parents are aware of any issues such as fines, and items returned will be removed from their accounts immediately and placed onto a library review account to prevent potential mistakes. Adult patrons will be able to decide on the type of card they would like to sign up for based on their use and or circumstances, welcome cards in the form of E-Cards will be given. These only allow for the use of computers in the library and for patrons to access all online and digital materials and resources, and full-service cards will be given the same access but will also be able to check out items in person but without the restrictions of a welcome and child account.

Functional Requirements

1. Public Library
    i. Shall have libraryId of Admin
    ii. Must have a County Name
    iii. Must have only one Library Address
    iv. Shall have many branches
    v. Shall have one and only E-Library

2. Library Branch
    i. Shall have unique libraryId
    ii. Shall have many Patrons
    iii. Must have only one Library Address
    iv. Shall have many Items
    v. Shall have many transactions

3. E-Library
    i. Shall have libraryId of Virtual
    ii. Must have only one Library Address shared with Public Library
    iii. Shall have many Patrons
    iv. Shall have many Digital Items
    v. Shall have many transactions

<u>Patrons</u>

4. Patron
    i. Shall have a Library Card Number
    ii. Must have a Library Card Type
    iii. Shall have access to many libraries
    iv. Shall have access to one e-library
    v. Must have only one email
    vi. Can only have one account
    vii. Can use one computer

<u>Patron Types</u>

5. E-Card
    i. Can only check out many digital items
    ii. Only has access to computer items in branch
    iii. Must have a birthday
    iv. Must have full name
    v. Does not need an address

6. Child
    i. Must have at least one parent's full-service account linked
    ii. Can check out 10 physical items and 15 digital items
    iii. Must have a birthday
    iv. Must have full name
    v. All other info derived from parent account

7. Full-Service
    i. Can have zero to many child accounts linked
    ii. Can check out 100 physical items and 50 digital items
    iii. Must have a phone number
    iv. Must have a birthday
    v. Must have full name

8. Institutional
    i. Can have an additional full-service library card linked
    ii. Can check out 250 physical items and no digital items
    iii. Must have Institutional Address
    iv. Must have full name

9. Staff
    i. Can check out 250 physical items and 50 digital items
    ii. Must have a phone number
    iii. Must have a birthday
    iv. Must have full name

<u>Addresses</u>

10. Address
    i. Shall have an address id
    ii. Shall have one to many users linked
    iii. Can have up to one address type
    iv. Must have Street Number
    v. Must have a Street Name
    vi. Must have City
    vii. Must have State
    viii. Must have Zipcode

<u>Address Types</u>

11. Apartment Address
    i. Must have a Building Number
    ii. Must have Apartment Number
    iii. Must have Phone Number Listed

12. P.O. Box Address
    i. Must have P.O. Box Number
    ii. Must have Servicer Listed
    iii. Must have Phone Number Listed

13. Institutional Address
    i. Must have School District listed
    ii. Must have School Name listed
    iii. Must have Phone Number Listed

14. Library Address
    i. Must have County Region
    ii. Must have branch ID
    iii. Must have Phone Number Listed

Items

15. Item
    i. Shall only be checked out to one patron at a time
    ii. Must have Item barcode number
    iii. Must have Call Number
    iv. Shall have zero to one Owning Library branch ID
    v. Must have Title
    vi. Shall have item type

Item Types

16. Computer
    i. Must have computer number
    ii. Shall have status of express or hourly
    iii. Must have area assigned
    iv. Shall have description (laptop or pc)

17. A/V
    i. Shall only be checked out when all materials are present
    ii. Must have a timestamp length
    iii. Must have an age rating
    iv. Must have an item count
    v. Must have a description

18. Fiction
    i. Must have at least one genre
    ii. Must have an Author
    iii. Must have an age rating
    iv. Must have a description

19. NonFiction
    i. Must have a Dewey decimal number
    ii. Must have a topic
    iii. Must have an Author
    iv. Must have an age rating

20. Archival
    i. Shall only be viewed inside the library
    ii. Must have a Dewey decimal number
    iii. Must have a topic
    iv. Must have a description

21. Periodical
    i. Current issues shall not be checked out
    ii. Must have an age rating
    iii. Must have Date
    iv. Must have Volume/Issue

22. Kit
    i. Shall only be checked out when all materials are present
    ii. Must have an age rating
    iii. Must have a description
    iv. Must have an item count

23. Pass
    i. Shall only be checked out when all materials are present
    ii. Must have a description
    iii. Must have an item count

24. Digital Item
    i. Must have Call Number
    ii. Must have Title
    iii. Must have description

Transactions

25. General
    i. Must have patron Library Card Number
    ii. Must have Transaction Type
    iii. Must have transaction ID

Transaction Types

26. Payment
    i. Must have staff library card number
    ii. Must have total paid
    iii. Must have date of transaction

27. Computer Loan
    i. Must have Item Barcode Number
    ii. Must have computer number
    iii. Must have Item's Library branch ID

28. Holds
    i. Must have Item Barcode Number
    ii. Must have Hold Library branch ID
    iii. Must have Owning Library Branch ID

29. Checkout
    i. Shall have one or many Item Barcode Numbers
    ii. Must have item count
    iii. Have date of transaction
    iv. Must have Checkout Library branch ID

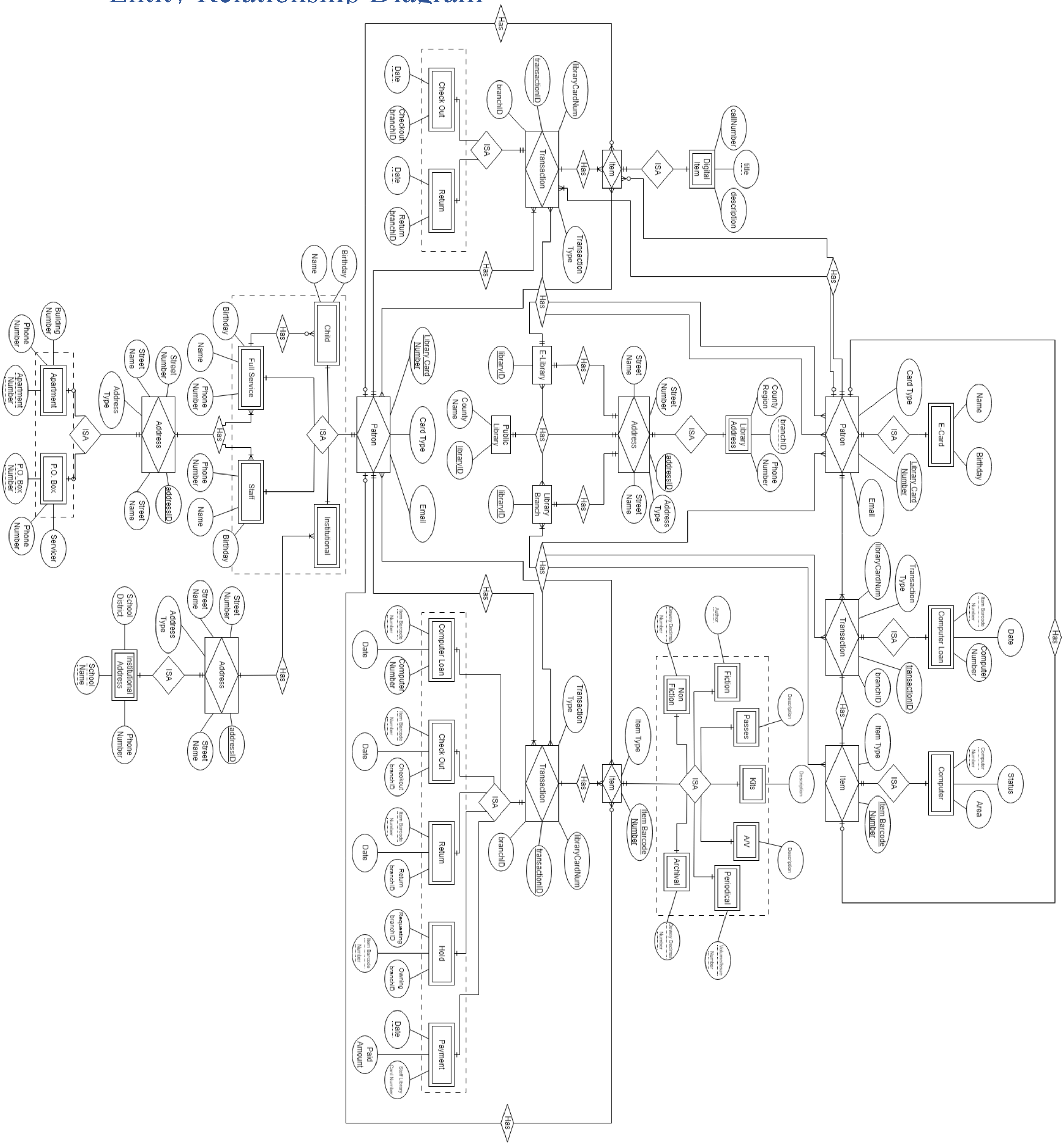
30. Return
    i. Shall have one or many Item Barcode Numbers
    ii. Must have item count
    iii. Have date of transaction
    iv. Must have Return Library branch ID

Non-Functional Requirements

1. Performance
    i. Library Transactions will be able to be performed simultaneously without conflicts and strain on the database
    ii. Requested and Held items will have status updates every day to prevent conflicting Patron Transactions
    iii. Digital Items will be separate from physical items on patron records to allow simultaneous transactions
2. Security
    i. Library card numbers are unique when created and assigned, upon the closure of an account or request for new library card old numbers are deleted and cannot be generated once more
    ii. Child account can only access account information in branch with Parent accounts being able to access information online and in branch
    iii. Accounts will be locked if library card is reported lost or stolen with a new library card number being assigned
3. Scalability
    i. Database is capability of expansion in order to account for new patrons, items, and transactions while avoiding compromising county wide performance
    ii. Data is stored locally and remotely, locally stored information is vital item, patron, and transaction information while remotely shared information is limited to allow branch level expansion without affecting other libraries
    iii. Main admin branch will be able to handle a large portion of the database in the form of transactions and general item and patron information taking a load off of the branches
4. Capability
    i. Items and Patrons are abstractions which will allow for future expansion on account types and new forms of materials
    ii. Digital Transactions such as Ebooks and Audio Books will be supported independently of in branch transactions
    iii. Account types will allow for different priority levels and capabilities to ensure patron need and circumstance is considered

5. Environmental
    i. Database will be hosted on server farm located in the main administrative branch with energy efficient design to remove the need for various large servers at each branch allowing for remote transfer and manipulation of data
    ii. In branch servers will be small raid configurations using solid state drives which can be stored in electrical room
    iii. As storage is expanded on servers old HDD's will be repurposed for archival and back up storage and be replaced with SSD's
6. Coding Standard
    i. Client Side support will be offered through the use of explicit error handling and reporting allowing staff to have accurate information on ongoing issues for them to generate work requests
    ii. Documentation and commenting will be common place and regularly updated for new and old staff to be able to work irregardless of familiarity with the database
    iii. Future Proofing will be essential and prioritized in order to make sure improvements and expansion to the database can be done without making it inaccessible county wide for a long period of time
7. Storage
    i. Patron information will be stored remotely but split amongst libraries and main admin branch and provided a capacity of 10 terabytes with capability of expansion
    ii. Transaction information will be stored remotely but split amongst libraries and main admin branch and be given 2 terabytes
    iii. Item information will be stored primarily with owning branches and share limited information remotely to other branches, capacity will be based on patron count of respective library
8. Privacy
    i. Patrons can only access their accounts with their respective library card number and birthday
    ii. Patron transactions will be deleted from record upon return of items
    iii. Parent accounts can only see amount of items checked out and fines on account but cannot see item details and content matter

Entity Relationship Diagram



Entity Set Description

1. Public Library (Strong)
    i. libraryID: numeric, primary key
    ii. County Name: alphanumeric
    iii. branchID: alphanumeric, unique key
    iv. address: numeric, foreign key

2. Library Branch (Strong)
    i. libraryID: numeric, primary key
    ii. branchID: alphanumeric, unique key
    iii. address: numeric, foreign key
    iv. is_virtual: BOOLEAN

3. E-Library (Strong)
    i. libraryID: numeric, primary key
    ii. branchID: alphanumeric, unique key
    iii. address: numeric, foreign key
    iv. is_virtual: BOOLEAN

<u>Patrons</u>

4. Patron (Strong)
    i. library_card_number: numeric, primary key
    ii. patronTypeID: numeric, foreign key
    iii. email: alphanumeric, unique key (child's is derived from parent)
    iv. address: numeric, foreign key

<u>Patron Types</u>

5. E-Card (Weak)
    i. e-cardID (typeID): numeric, primary key
    ii. name: alphanumeric
    iii. birthday: date

6. Child (Weak)
    i. childID (typeID): numeric, primary key
    ii. parentID (parent's typeID): numeric, foreign key
    iii. address: derived, numeric, foreign key
    iv. first_name: alphanumeric
    v. last_name: alphanumeric
    vi. birthday: date
    vii. phone_number: derived, numeric, composite and multi-value

7. Full-Service (Weak)
    i. patronID (typeID): numeric, primary key
    ii. address: numeric, foreign key
    iii. first_name: alphanumeric
    iv. last_name: alphanumeric
    v. birthday: date
    vi. phone_number: numeric, composite and multi-value

8. Institutional (Weak)
    i. institutionalID (typeID): numeric, primary key
    ii. address: numeric, foreign key
    iii. first_name: alphanumeric
    iv. last_name: alphanumeric
    v. phone_number: numeric, composite and multi-value

9. Staff (Weak)
    i. staffID (typeID): numeric, primary key
    ii. address: numeric, foreign key
    iii. first_name: alphanumeric
    iv. last_name: alphanumeric
    v. birthday: date
    vi. phone_number: numeric, composite and multi-value

Addresses

10. Address (Strong)
    i. addressID: numeric, primary key
    ii. addressTypeID: numeric, foreign key
    iii. street_number: numeric
    iv. street_name: alphanumeric
    v. city: alphanumeric
    vi. state: alphanumeric
    vii. zipcode: numeric

Address Types

11. Apartment Address (Weak)
    i. apartmentID (typeID): numeric, primary key
    ii. building_number: numeric
    iii. apartment_number: numeric
    iv. phone_number: numeric, composite and multi-value

12. P.O. Box Address (Weak)
    i. po_boxID(typeID): numeric, primary key
    ii. po_box_number: numeric
    iii. servicer: alphanumeric
    iv. phone_number: numeric, composite and multi-value

13. Institutional Address (Weak)
    i. institutionID (typeID): numeric, primary key
    ii. school_district: alphanumeric
    iii. school_name: alphanumeric
    iv. phone_number: numeric, composite and multi-value

14. Library Address (Weak)
    i. libraryAddressID (typeID): numeric, primary key
    ii. county_region: alphanumeric
    iii. branchID: alphanumeric, foreign key
    iv. phone_number: numeric, composite and multi-value

Items

15. Item (Strong)
    i. item_barcode_number: numeric, primary key
    ii. itemTypeID: numeric, foreign key
    iii. call_number: alphanumeric
    iv. title: alphanumeric
    v. branchID: numeric, foreign key

Item Types

16. Computer (Weak)
    i. computerID (typeID): numeric, primary key
    ii. computer_number: numeric, unique key
    iii. is_express: BOOLEAN
    iv. is_laptop: BOOLEAN
    v. area: alphanumeric
    vi. description: alphanumeric

17. A/V (Weak)
    i. avID(typeID): numeric, primary key
    ii. content_length: timestamp
    iii. age_rating: alphanumeric
    iv. item_count: numeric
    v. description: alphanumeric

18. Fiction (Weak)
    i. fictionID (typeID): numeric, primary key
    ii. genre: alphanumeric
    iii. author_first_name: alphanumeric
    iv. author_last_name: alphanumeric
    v. age_rating: alphanumeric
    vi. description: alphanumeric

19. NonFiction (Weak)
    i. nonFictionID(typeID): numeric, primary key
    ii. dewey_decimal_number: numeric
    iii. library_of_congess_classification: alphanumeric
    iv. topic: alphanumeric
    v. author_first_name: alphanumeric
    vi. author_last_name: alphanumeric
    vii. age_rating: alphanumeric

20. Archival (Weak)
    i. archivalID (typeID): numeric, primary key
    ii. dewey_decimal_number: numeric
    iii. library_of_congess_classification: alphanumeric
    iv. item_count: numeric
    v. description: alphanumeric

21. Periodical (Weak)
    i. periodicalID (typeID): numeric, primary key
    ii. publisher: alphanumeric
    iii. age_rating: alphanumeric
    iv. issue_date: date
    v. volume: numeric
    vi. issue: numeric

22. Kit (Weak)
    i. libraryAddressID (typeID): numeric, primary key
    ii. age_rating: alphanumeric
    iii. item_count: numeric
    iv. description: alphanumeric

25. Pass (Weak)
    i. libraryAddressID (typeID): numeric, primary key
    ii. item_count: numeric
    iii. description: alphanumeric

26. Digital Item (Weak)
    i. libraryAddressID (typeID): numeric, primary key
    ii. content_length: alphanumeric
    iii. description: alphanumeric

Transactions

26. Transaction (Strong)
    i. transactionID: numeric, primary key
    ii. patronCardNumber: numeric, foreign key
    iii. transactionTypeID, numeric, foreign key
    iv. transaction_branchID: numeric, foreign key
    v. description: alphanumeric

Transaction Types

27. Payment (Weak)
    i. paymentID (typeID), numeric, primary key
    ii. staffCardNumber: numeric, foreign key
    iii. item_barcode_number: numeric, foreign key
    iv. total_paid: numeric
    v. total_due: numeric
    vi. is_paid_off: BOOLEAN
    vii. date_paid: date

28. Computer Loan (Weak)
    i. loanID (typeID), numeric, primary key
    ii. item_barcode_number: numeric, foreign key
    iii. computer_number: numeric, foreign key
    iv. branchID: numeric

29. Holds (Weak)
    i. holdID (typeID), numeric, primary key
    ii. item_barcode_number: numeric, foreign key
    iii. owning_branchID: numeric, foreign key
    iv. holding_branchID: numeric, foreign key

30. Checkout (Weak)
    i. checkoutID (typeID), numeric, primary key
    ii. item_barcode_number: numeric, foreign key
    iii. checkout_branchID: numeric, foreign key
    iv. checkout_date: date
    v. item_count: numeric

31. Return (Weak)
    i. returnID (typeID), numeric, primary key
    ii. item_barcode_number: numeric, foreign key
    iii. return_branchID: numeric, foreign key
    iv. return_date: date
    v. item_count: numeric

Enhanced Entity-Relationship Diagram

Normalization Techniques Used

ORM Architecture