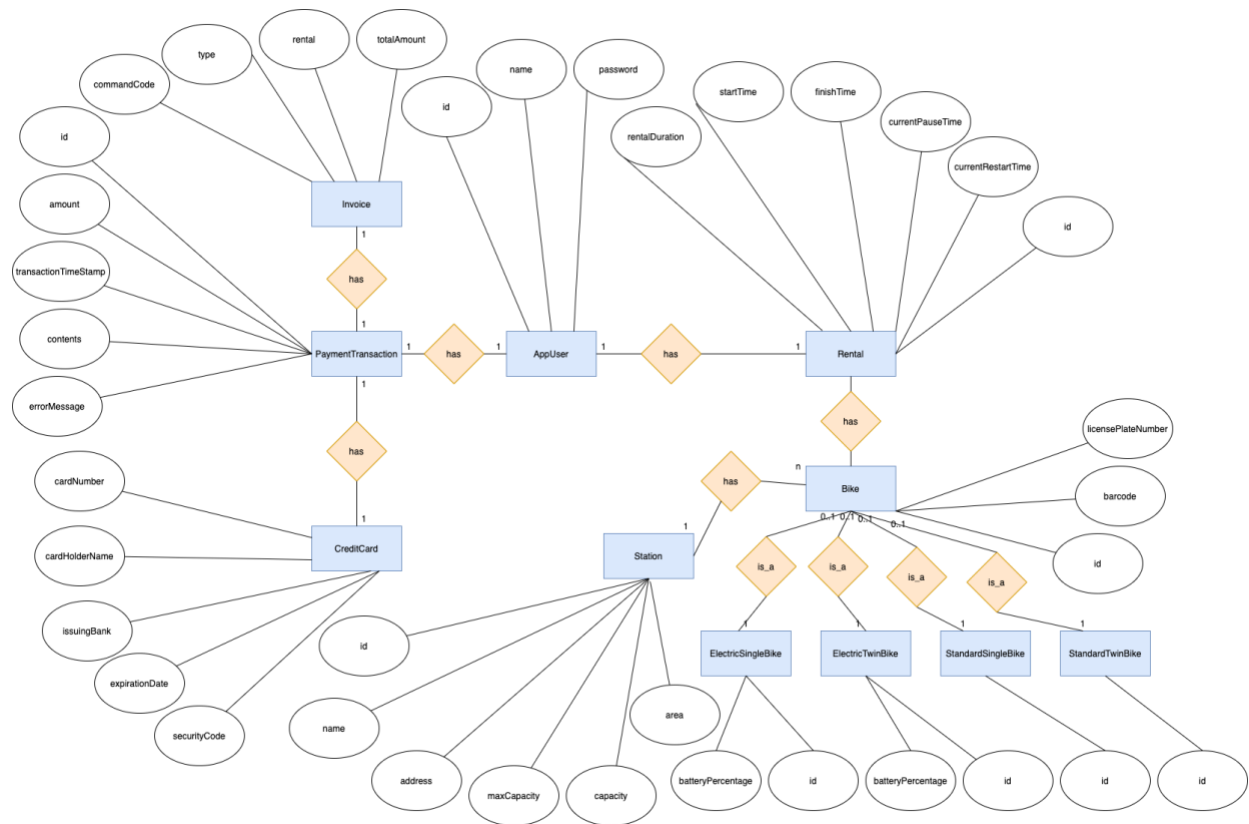


1 Conceptual Data Modeling



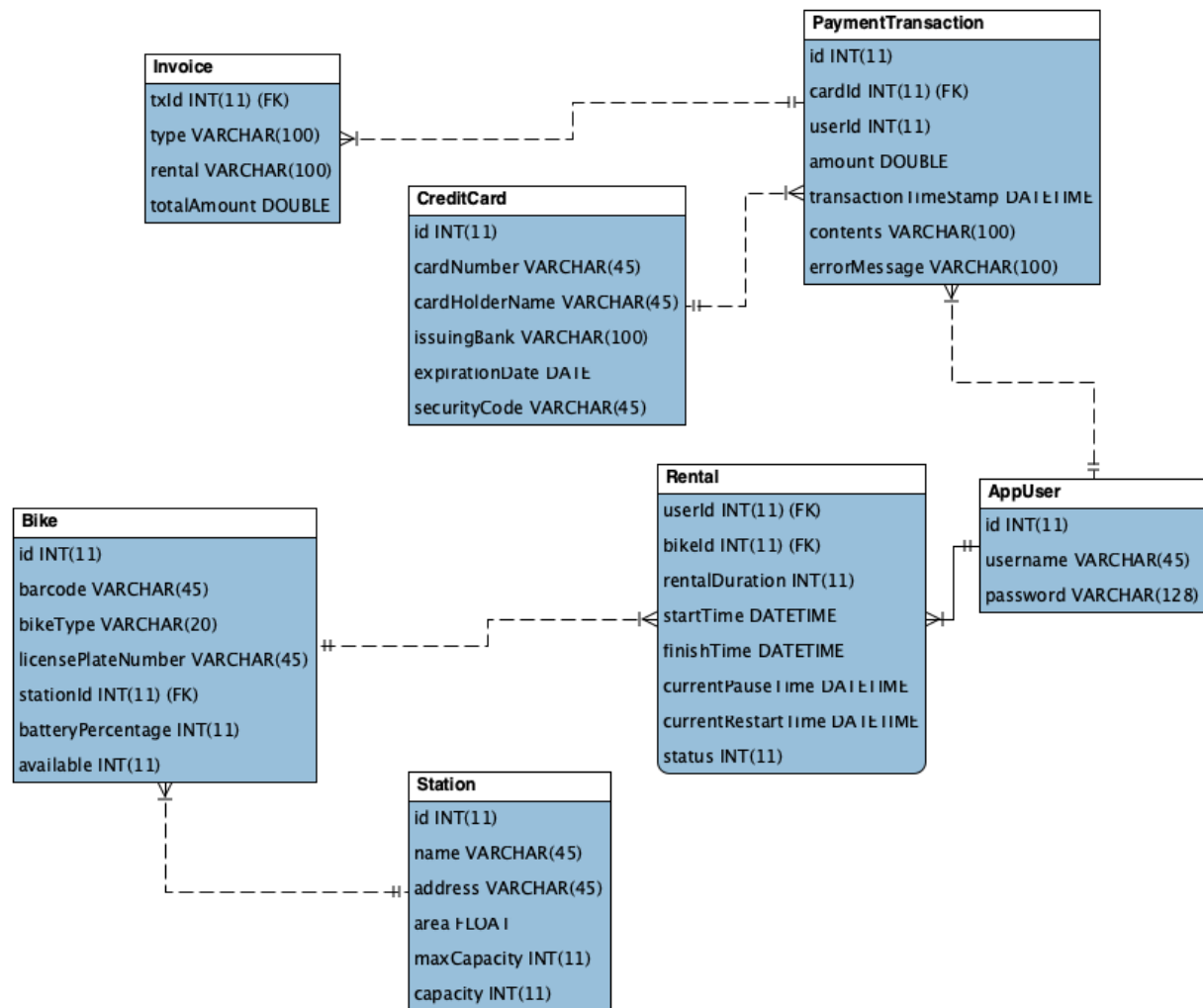
2 Database Design

2.1 Database Management Systems

Database Management System: MySQL

MySQL is an open-source relational database management system.

2.2 Logical Data Model



2.3 Physical Data Model

AppUser

#	PK	FK	Column Name	Data Type	Mandatory	Description
1	X		id	Integer	Yes	Id, auto increment
2			username	Varchar(45)	Yes	Name of user
3			password	Varchar(128)	Yes	Password of user

Rental

#	PK	FK	Column Name	Data Type	Mandatory	Description
1	x	x	userId	Integer	Yes	User's ID

2	x	x	bikeID	Integer	Yes	Bike's ID
3			rentalDuration	Integer	Yes	Duration of renting
4			startTime	Datetime	Yes	Time start renting
5			finishTime	Datetime	Yes	Time finish renting
6			currentPauseTime	Datetime	Yes	Current time of pausing
7			currentRestartTime	Datetime	Yes	Current time of restarting
8			status	Integer	Yes	Status of renting

Bike

#	PK	FK	Column Name	Data Type	Mandatory	Description
1	X		id	Integer	Yes	Id, auto increment
2			barcode	Varchar(45)	Yes	Barcode of bike
3			bikeType	Varchar(20)	Yes	The type of the bike
4			licensePlateNumber	Varchar(45)	Yes	License plate number of bike
5		X	stationId	Integer	No	station's ID
6			batteryPercentage	Integer	No	The battery percentage of the bike
7			available	Integer	Yes	The availability of the bike

Station

#	PK	FK	Column Name	Data Type	Mandatory	Description
1	X		id	Integer	Yes	Id, auto increment
2			name	Varchar(45)	Yes	Name of station
3			address	Varchar(45)	Yes	Address of station
4			area	Float	Yes	The area of the station

5			maxCapacity	Integer	Yes	Max capacity of station
6			capacity	Integer	Yes	Current capacity of station

PaymentTransaction

#	PK	FK	Column Name	Data Type	Mandatory	Description
1	X		id	Integer	Yes	Id, auto increment
2		x	cardId	Integer	Yes	Card's ID
3		x	userId	Integer	Yes	User's ID
4			amount	Integer	Yes	Amount of transaction
5			transactionTimeStamp	Datetime	Yes	Time of transaction
6			contents	Varchar(100)	Yes	Contents of transaction
7			errorMessage	Varchar(100)	Yes	Error message of transaction

Credit Card

#	PK	FK	Column Name	Data Type	Mandatory	Description
1	X		id	Integer	Yes	Id, auto increment
2			cardNumber	Varchar(45)	Yes	Number of card
3			cardHolderName	Varchar(45)	Yes	Holder name of card
4			issuingBank	Varchar(100)	Yes	Issuing bank of card
5			expirationDate	Date	Yes	Error message of transaction
6			securityCode	Varchar(45)	Yes	Expiration Date of card

Invoice

#	PK	FK	Column Name	Data Type	Mandatory	Description
1	x		txId	Integer	Yes	Id, auto increment

2			type	Varchar(100)	Yes	Type of payment: deposit, payment, refund
3			rental	Varchar(100)	Yes	Status: pay or refund
4			totalAmount	Varchar(100)	Yes	Renting money

Database Script:

```
CREATE TABLE AppUser(
    id INTEGER PRIMARY KEY AUTO_INCREMENT NOT NULL,
    username VARCHAR(45) NOT NULL,
    password VARCHAR(128) NOT NULL
);
```

```
CREATE TABLE Station(
    id INTEGER PRIMARY KEY AUTO_INCREMENT NOT NULL,
    name VARCHAR(45) NOT NULL,
    address VARCHAR(45) NOT NULL,
    area FLOAT NOT NULL,
    maxCapacity INTEGER NOT NULL,
    capacity INTEGER NOT NULL
);
```

```
CREATE TABLE Bike(
    id INTEGER PRIMARY KEY AUTO_INCREMENT NOT NULL,
    barcode VARCHAR(45) NOT NULL,
    bikeType VARCHAR(20) NOT NULL,
    licensePlateNumber VARCHAR(45) NOT NULL,
    stationId INTEGER,
    batteryPercentage INTEGER DEFAULT 0,
```

```
    available INTEGER DEFAULT 1,  
    CONSTRAINT fk_Bike_Station1 FOREIGN KEY (stationId) REFERENCES Station(id)  
);
```

```
CREATE TABLE Rental(  
    userId INTEGER NOT NULL,  
    bikeId INTEGER NOT NULL,  
    rentalDuration INTEGER DEFAULT 0,  
    startTime DATETIME DEFAULT CURRENT_TIMESTAMP,  
    finishTime DATETIME,  
        currentPauseTime DATETIME,  
        currentRestartTime DATETIME,  
    status INTEGER DEFAULT 0,  
    PRIMARY KEY (userId, startTime),  
    CONSTRAINT fk_Rental_User1 FOREIGN KEY(userId) REFERENCES AppUser(id),  
    CONSTRAINT fk_Rental_Bike1 FOREIGN KEY(bikeId) REFERENCES Bike(id)  
);
```

```
CREATE TABLE CreditCard(  
    id INTEGER PRIMARY KEY AUTO_INCREMENT NOT NULL,  
    cardNumber VARCHAR(45) NOT NULL,  
    cardHolderName VARCHAR(45) NOT NULL,  
    issuingBank VARCHAR(100) NOT NULL,  
    expirationDate DATE NOT NULL,  
    securityCode VARCHAR(45) NOT NULL  
);
```

```
CREATE TABLE PaymentTransaction(  
    id INTEGER PRIMARY KEY AUTO_INCREMENT NOT NULL,
```

```

    cardId INTEGER NOT NULL,
    userId INTEGER NOT NULL,
    amount REAL NOT NULL,
    transactionTimeStamp DATETIME NOT NULL,
    contents VARCHAR(100) NOT NULL,
    errorMessage VARCHAR(100) NOT NULL,
    CONSTRAINT fk_PaymentTransaction_CreditCard1 FOREIGN
    KEY(cardId)REFERENCES CreditCard(id),
    CONSTRAINT fk_PaymentTransaction_User1 FOREIGN KEY(cardId)REFERENCES
    AppUser(id)
);

```

```

CREATE TABLE Invoice(
    txId INTEGER DEFAULT NULL,
    type VARCHAR(100) NOT NULL,
    rental VARCHAR(100) NOT NULL,
    totalAmount REAL NOT NULL,
    PRIMARY KEY(type,rental),
    CONSTRAINT fk_Invoice_PaymentTransaction1 FOREIGN KEY(txId)REFERENCES
    PaymentTransaction(id)
);

```