

# Databases Homework 1

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Domain: Technology transfer, 42

## Introduction:

In the realm of technology transfer, the exchange of innovative solutions between owner organizations and receiver organizations is paramount for driving progress and fostering innovation. Developing a dedicated database system (Technology Transfer Database System) tailored to the needs of technology transfer can significantly enhance the efficiency and effectiveness of the transfer process. This document outlines the systematic approach to developing Technology Transfer Database System within the domain of technology transfer. From specifying the mission and objectives to eliciting requirements, refining the conceptual model, and ultimately delivering a robust software solution, this document provides a comprehensive roadmap for leveraging Technology Transfer Database System to optimize technology transfer processes.

## Step 1.1: Specify the Mission & Objectives for your DBS

### Business: Technology Transfer Platform

#### Mission:

At the executive level, the development of a technology transfer database system (myDBS) is deemed essential to propel our organization's innovation agenda, foster collaboration, and streamline the process of technology exchange. This initiative is indispensable to enhance our competitive edge in the dynamic landscape of technology transfer and capitalize on emerging opportunities for growth and development.

The myDBS will cover the entire spectrum of technology transfer activities within our organization, encompassing the documentation, negotiation, and licensing of intellectual property rights (IPR) and technologies. It is imperative for stakeholders across various user groups, including owner organizations, receiver organizations, legal and regulatory authorities, technology transfer professionals, and intellectual property offices.

While myDBS may leverage existing database systems, its development signifies a significant enhancement and refinement to meet the evolving needs and challenges of technology transfer. It represents a strategic investment to modernize and optimize our technology transfer processes, ensuring alignment with industry best practices and regulatory requirements.

Efficiency and effectiveness in myDBS implementation will be measured through key performance indicators (KPIs) such as:

- Reduction in time-to-market for technology transfers
- Increase in the number of successful technology transfers
- Improvement in collaboration and communication between stakeholders
- Compliance with legal and regulatory frameworks
- Enhanced data integrity and security measures
- Flexibility and scalability of the system to accommodate future growth and changes

### **Scope:**

The Technology Transfer Database System will serve as a comprehensive platform to facilitate the exchange of technology between owner organizations and receiver organizations. It will streamline the transfer process, from initial technology discovery to final licensing agreements, while ensuring compliance with relevant laws and regulations, product development according to technology, and catering to individuals interested in this product. The database system will focus exclusively on features and functionality directly related to technology transfer, such as technology documentation, collaboration tools, licensing management, and intellectual property rights (IPR) tracking. The Technology Transfer Database System will not include extraneous features unrelated to technology transfer, such as entertainment or unrelated business processes.

### **Operations:**

- Facilitate technology discovery and documentation.
- Support collaboration between owner and receiver organizations.
- Manage technology licenses and associated intellectual property rights.
- Ensure compliance with legal and regulatory requirements.
- Provide comprehensive reporting and analytics on technology transfer activities.
- Develop product based on technology and interests of stakeholders.

### **Tasks per operation:**

- **Operation:** Facilitate technology discovery and documentation
  - Enable owner organizations to input detailed descriptions of their technologies into the system.
  - Provide receiver organizations with intuitive search and browsing capabilities to explore available technologies
  - Enable investors to check, be involved in transfer process
- **Operation:** Support collaboration between owner and receiver organizations
  - Facilitate communication and negotiation between parties involved in technology transfer.
  - Enable secure document exchange and version control for technology-related documents.

- **Operation:** Manage technology licenses and associated intellectual property rights
  - Track and manage technology licenses, agreements, and IPR associated with transferred technologies.
  - Ensure that all transactions comply with relevant legal and regulatory frameworks.
  
- **Operation:** Provide comprehensive reporting and analytics
  1. Generate reports on technology transfer activities, including the number of transfers completed, revenue generated from licensing, and trends in technology demand.
  2. Utilize data analytics to identify opportunities for process improvement and strategic decision-making.
  
- **Operation:** Develop product based on technology and interests of stakeholders
  - Collaborate with stakeholders to identify product development opportunities based on transferred technologies.
  - Ensure alignment of product development with the interests and needs of stakeholders.

#### **General stakeholders for myDBS:**

- *Investors:* Monitor technology transfer processes and ensure efficient allocation of resources.
- *Customers:* Benefit from improved technology transfer processes and use the product developed by technology.
- *Organization staff:* Input technologies, manage transfer processes, and collaborate with stakeholders.
- *Intellectual Property Offices:* Track and manage intellectual property rights associated with transferred technologies.
- *Partnership coordinators:* Facilitate communication and negotiation between collaboration of organizations involved in the transfer process.

#### **Task per operation with stakeholders invoked:**

- **Operation:** Facilitate technology discovery and documentation
  - Organization staff: Input detailed descriptions of technologies.
  - Customers: Explore available technologies through intuitive search interfaces.
  
- **Operation:** Support collaboration between owner and receiver organizations

- Partnership coordinators: Facilitate communication and negotiation between parties.
  - Organization staff: Exchange documents securely through the platform.
- **Operation:** Manage technology licenses and associated intellectual property rights
- Intellectual Property Offices: Track and manage intellectual property rights associated with transferred technologies.
- **Operation:** Ensure compliance with legal and regulatory requirements
- Compliance Authority: Oversee compliance with regulations.
  - Organization staff: Ensure that technology transfer processes adhere to legal requirements.
- **Operation:** Provide comprehensive reporting and analytics
- Partnership coordinators: Utilize reports and analytics to optimize transfer processes.
  - Investors: Monitor key performance indicators and trends in technology transfer activities.
- **Operation:** Gather feedback about products
- Customers: Provide feedback about products based on technology usage and experience.

### **Objectives:**

- Facilitate Technology Transfer: Enable discovery, documentation, and exchange of technologies between owner and receiver organizations.
- Support Collaboration: Provide tools and features to facilitate communication, negotiation, and document exchange between involved parties.
- Manage Licensing and IPR: Track and manage technology licenses, agreements, and intellectual property rights associated with transferred technologies.
- Ensure Compliance: Implement robust security measures and compliance mechanisms to ensure adherence to legal and regulatory requirements.
- Provide Reporting and Analytics: Generate comprehensive reports and analytics to monitor and optimize technology transfer activities, provide analytics of product effectiveness, usage and performance developed by technology.

## **Step 1.2: Elicit Requirements for Your DBS**

### **1.) Reporting and Analysis:**

- The database system should be capable of generating reports and analyzing technology transfer data to identify trends, assess efficiency, and optimize processes.

### **2.) Technology Discovery and Documentation:**

- Enable organization staff to input detailed descriptions of technologies.
- Provide customers with intuitive search interfaces to explore available technologies.

### **3.) Collaboration Support:**

- Facilitate communication and negotiation between owner and receiver organizations.
- Enable secure document exchange and version control for technology-related documents.

### **4.) License and Intellectual Property Rights Management:**

- Track and manage technology licenses, agreements, and associated intellectual property rights.
- Ensure all transactions comply with relevant legal and regulatory frameworks.

### **5.) Comprehensive Reporting and Analytics:**

- Generate reports on technology transfer activities, revenue generation, and trends in technology demand.
- Utilize data analytics to identify opportunities for process improvement and strategic decision-making.

### **6.) Product Development Alignment:**

- Collaborate with stakeholders to identify product development opportunities based on transferred technologies.
- Ensure alignment of product development with the interests and needs of stakeholders.

## **7.) Stakeholder Engagement and Feedback:**

- Gather feedback about products based on technology usage and experience from customers.
- Monitor key performance indicators and trends in technology transfer activities to address stakeholders' concerns and optimize processes

## **Step 1.3: Develop External Views as UML Class Diagrams**

### **Explanation of Classes:**

#### **Investor:**

- Represents investors involved in monitoring technology transfer processes and ensuring efficient resource allocation.
- Connected to transfer invests and technology.

#### **Customer:**

- Represents customers benefiting from improved technology transfer processes and using products developed by technology.
- Connected to Technology Transfer Platform for accessing and using product developed by technology.

#### **OrganizationStaff:**

- Represents staff members of owner and receiver organizations involved in inputting technologies, managing transfer processes, and collaborating with stakeholders.
- Connected to Technology Transfer Platform for belonging to owner and receiver organizations.

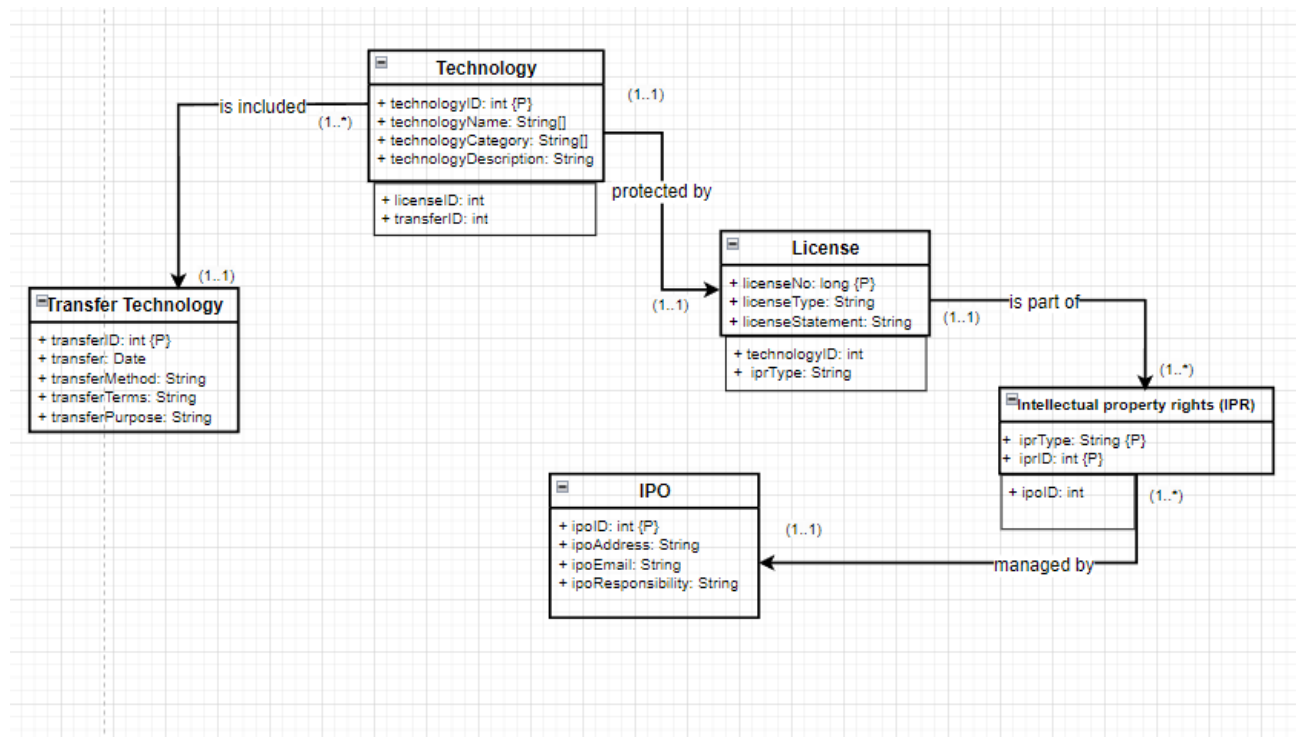
#### **IntellectualPropertyOffice (IPO):**

- Represents offices responsible for tracking and managing intellectual property rights associated with transferred technologies.
- Connected to Technology Transfer Platform for managing IP rights.

#### **PartnershipCoordinator:**

- Represents professionals facilitating communication and negotiation between collaborating organizations involved in the transfer process.
- Connected to Technology Transfer Platform for communication and collaboration.

## IntellectualPropertyOffice UML



ipoID – intellectual property office ID

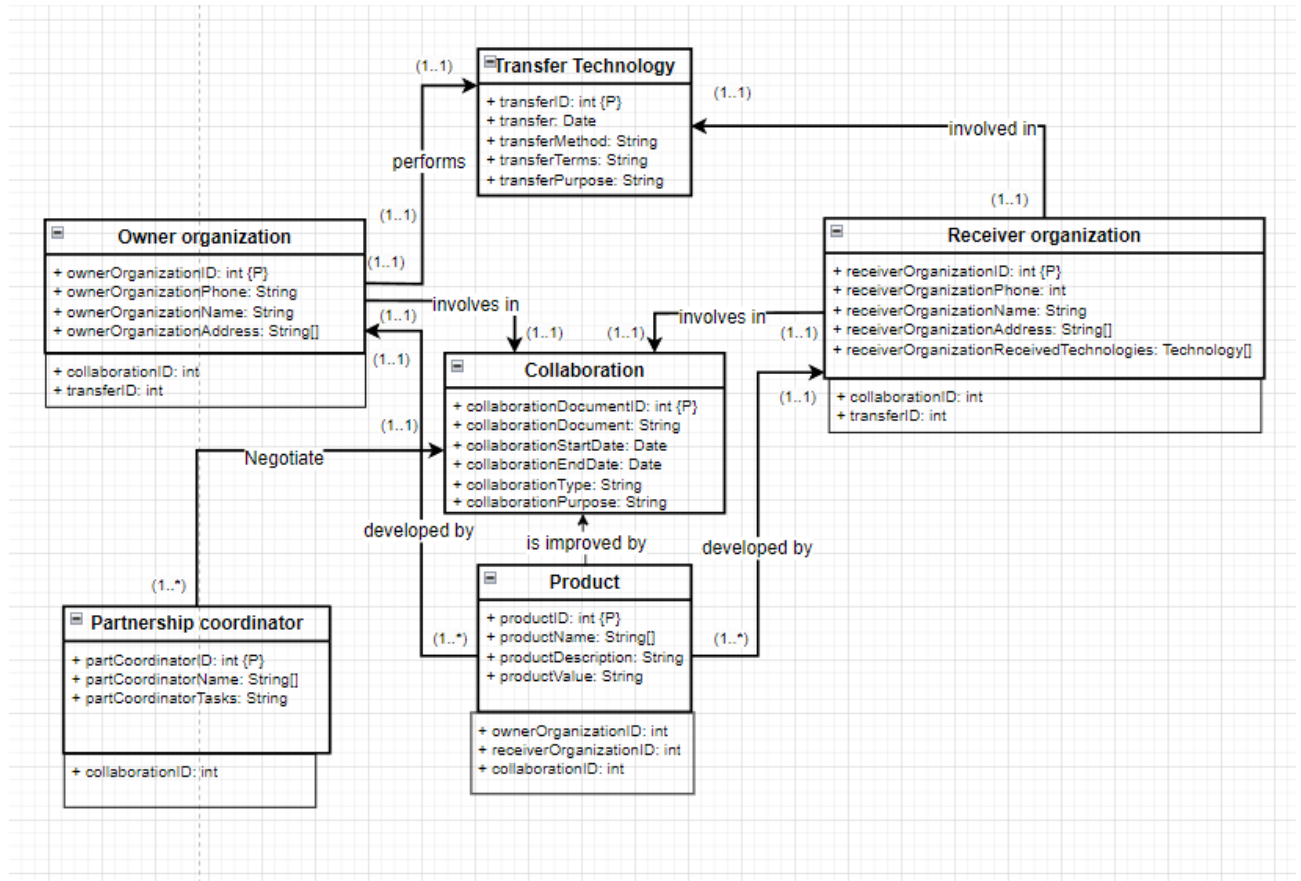
ipoAddress – address of intellectual property office

ipoEmail – email of intellectual property office

ipoResponsibilities – responsibilities of intellectual property office for IPR

Added for Intellectual Property Rights foreign key of Intellectual Property Office ID

## PartnershipCoordinator UML



partCoordID – ID of partnership coordinator (primary key)

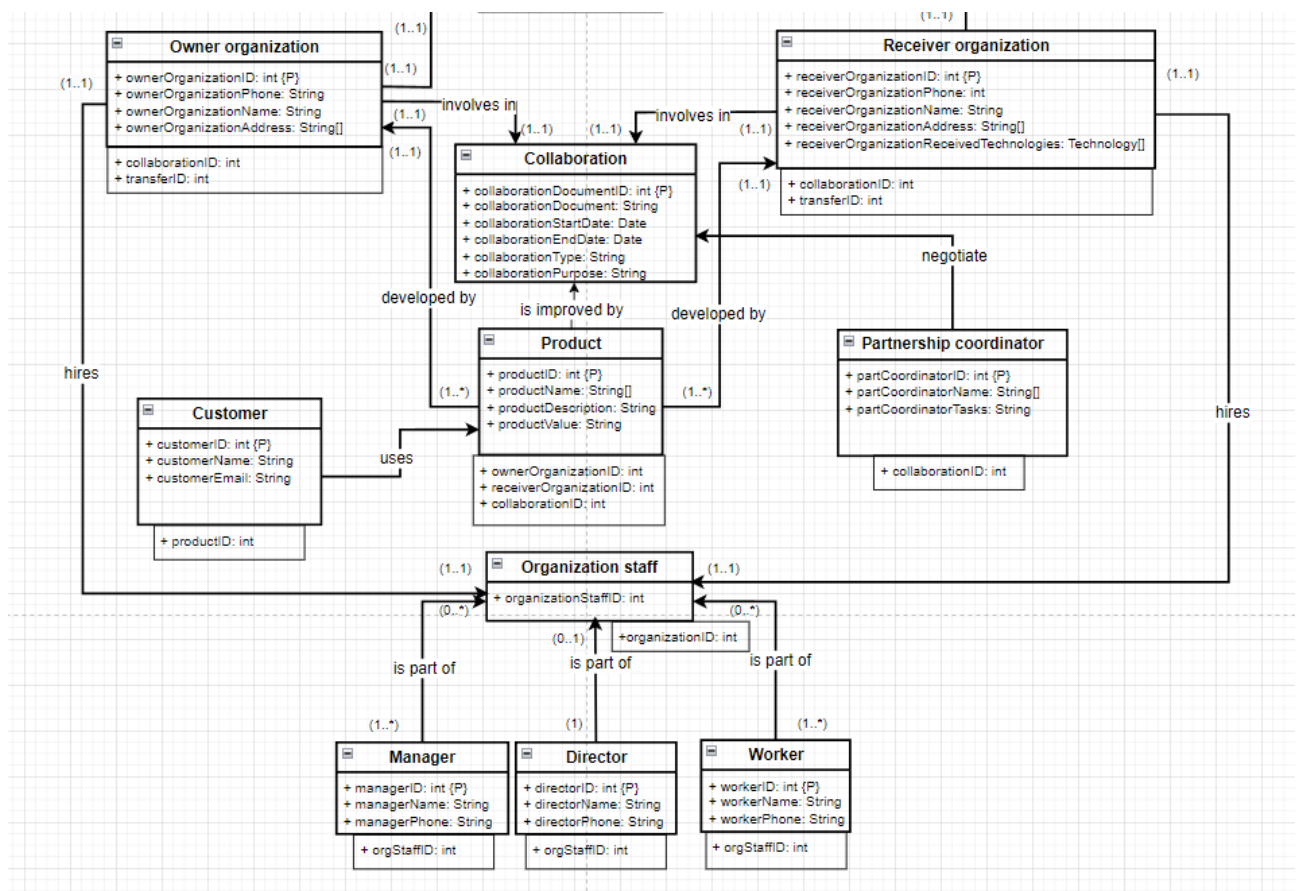
partCoordName – name of partnership coordinator

partCoordinatorTasks – tasks and aims for partnership coordinator

collaborationID – foreign key of collaboration that partnership coordinator is dealing or negotiating



## OrganizationStaff UML



Organization staff was already present in my UML diagram from HW 1

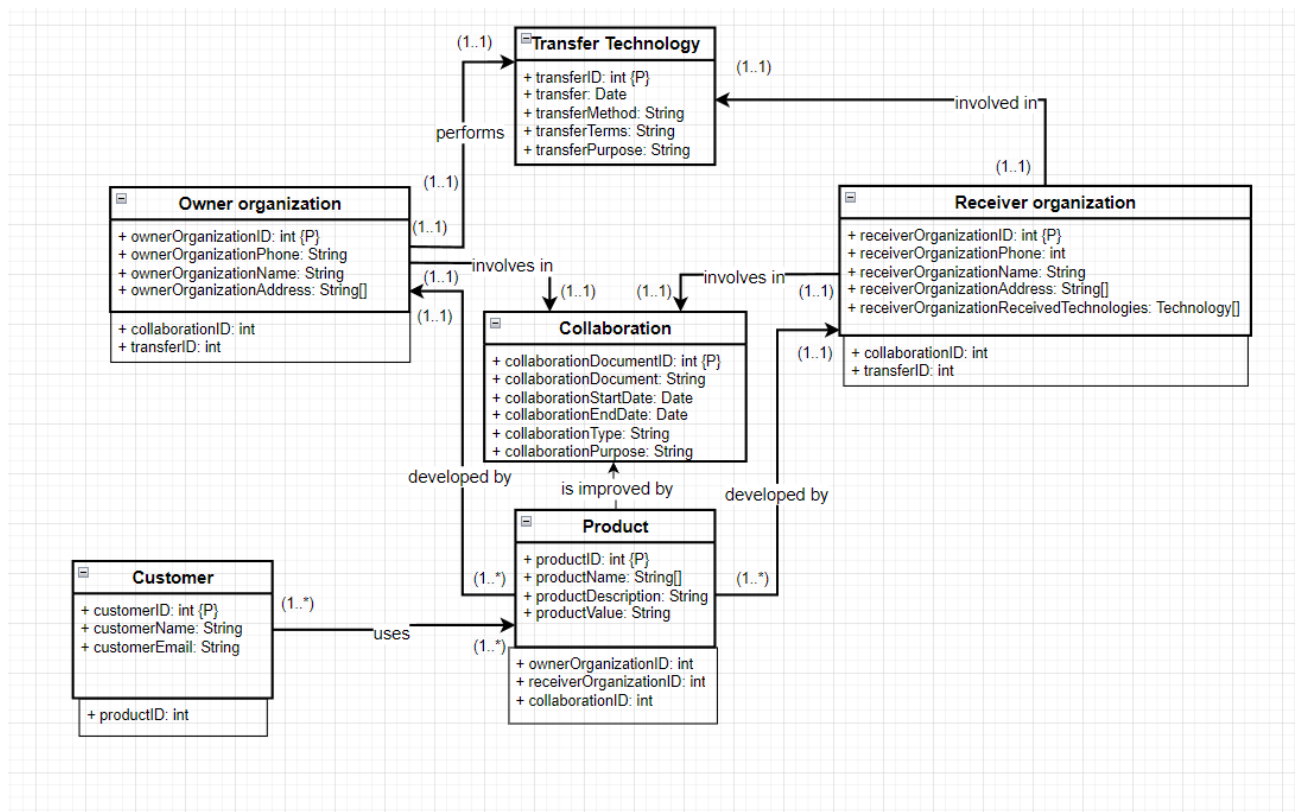
ID attributes of worker, director and manager is their ID's and primary keys

Names attributes are the name of worker, director and manager

Phone attributes are the phone numbers of worker, director and manager

orgStaffID – is ID of foreign key to what organization staff they belong (staffs are different)

## Customer UML



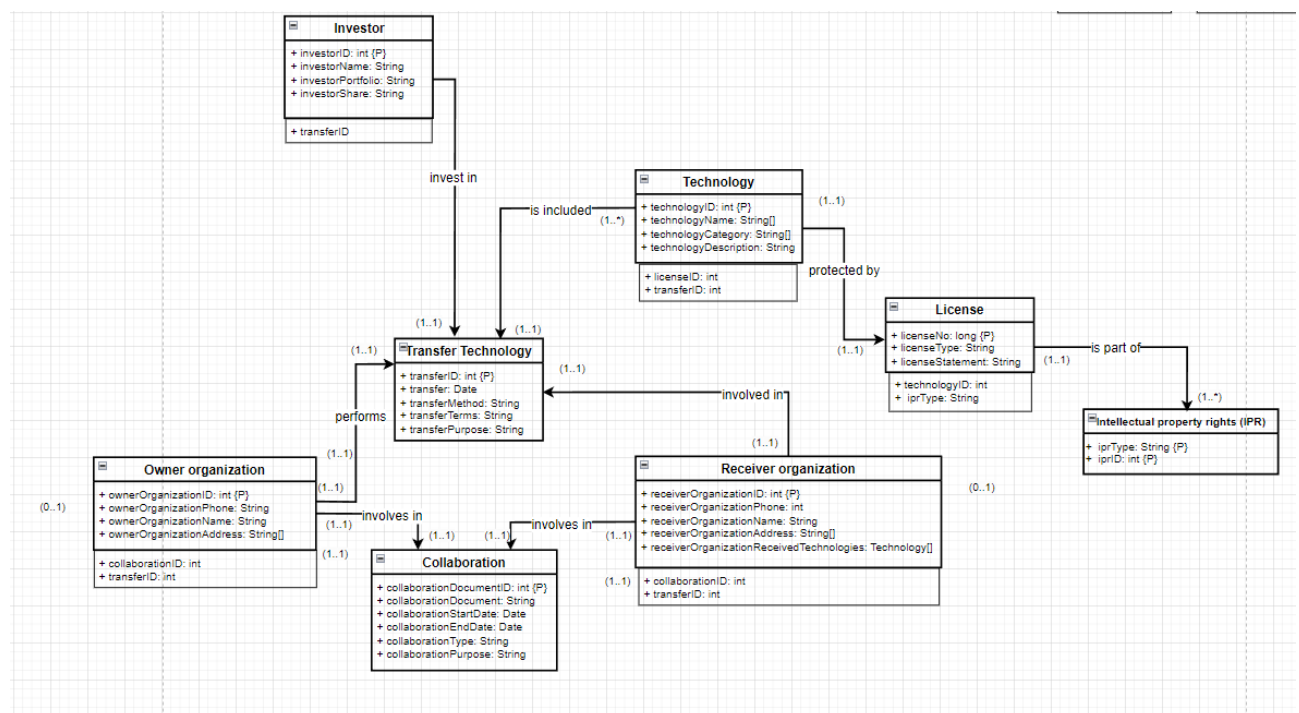
customerID – ID of the customer or client (primary key)

customerName – name of the customer

customerEmail - email of the customer

productID – foreign key of the product that is consumption or using by customer

## Investor UML



investorID – ID of the investor

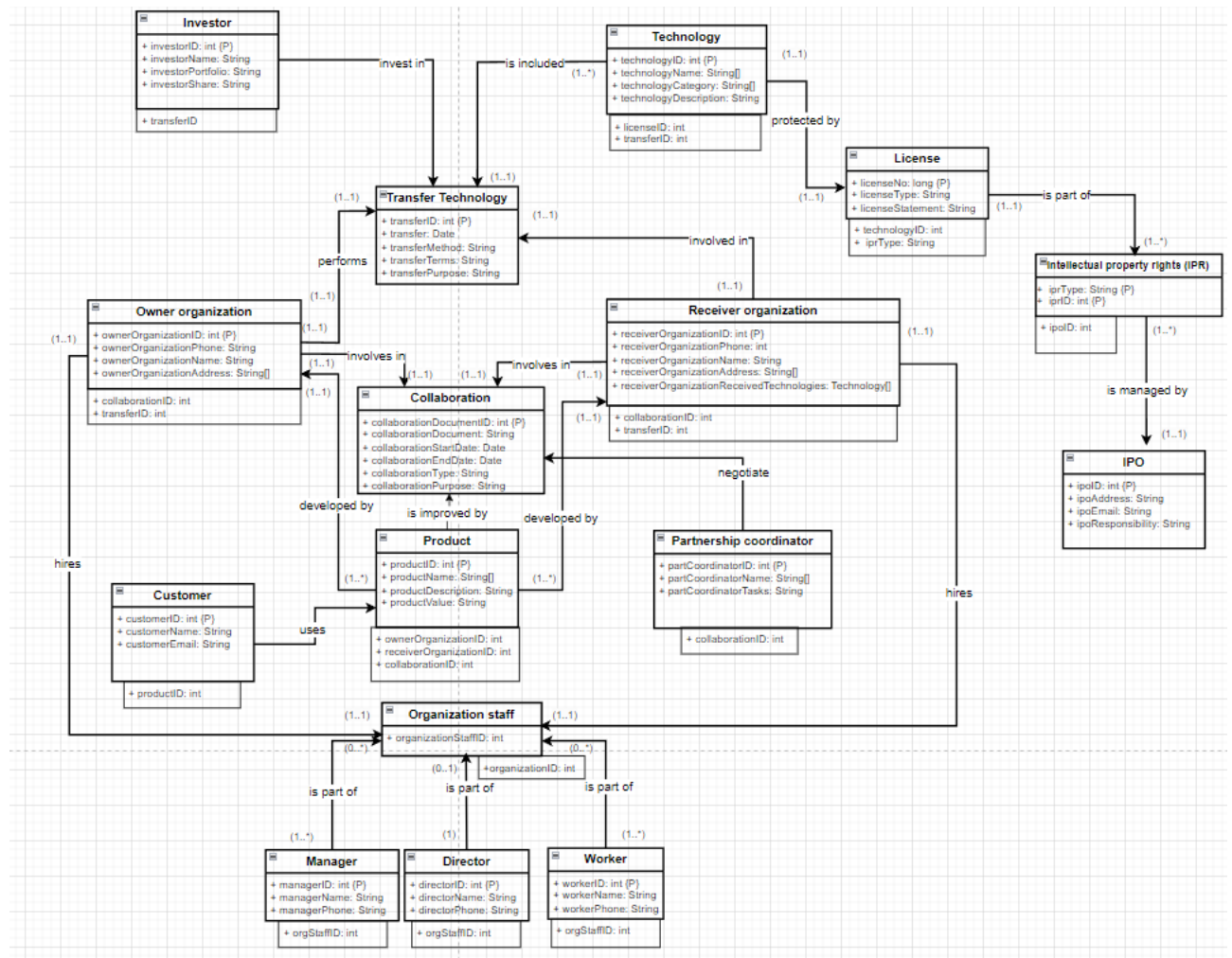
investorName – name of the investor

investorPortfolio – stores information such as the types of investments, investment amounts, and investment performance and helps track the investment activities and interests of each investor

investorShare - represents the share or ownership (also can be revenue) percentage of the investor in a particular transfer with particular technologies

## Step 1.4: Refine Your Conceptual Model (HW1) Based on the External Views

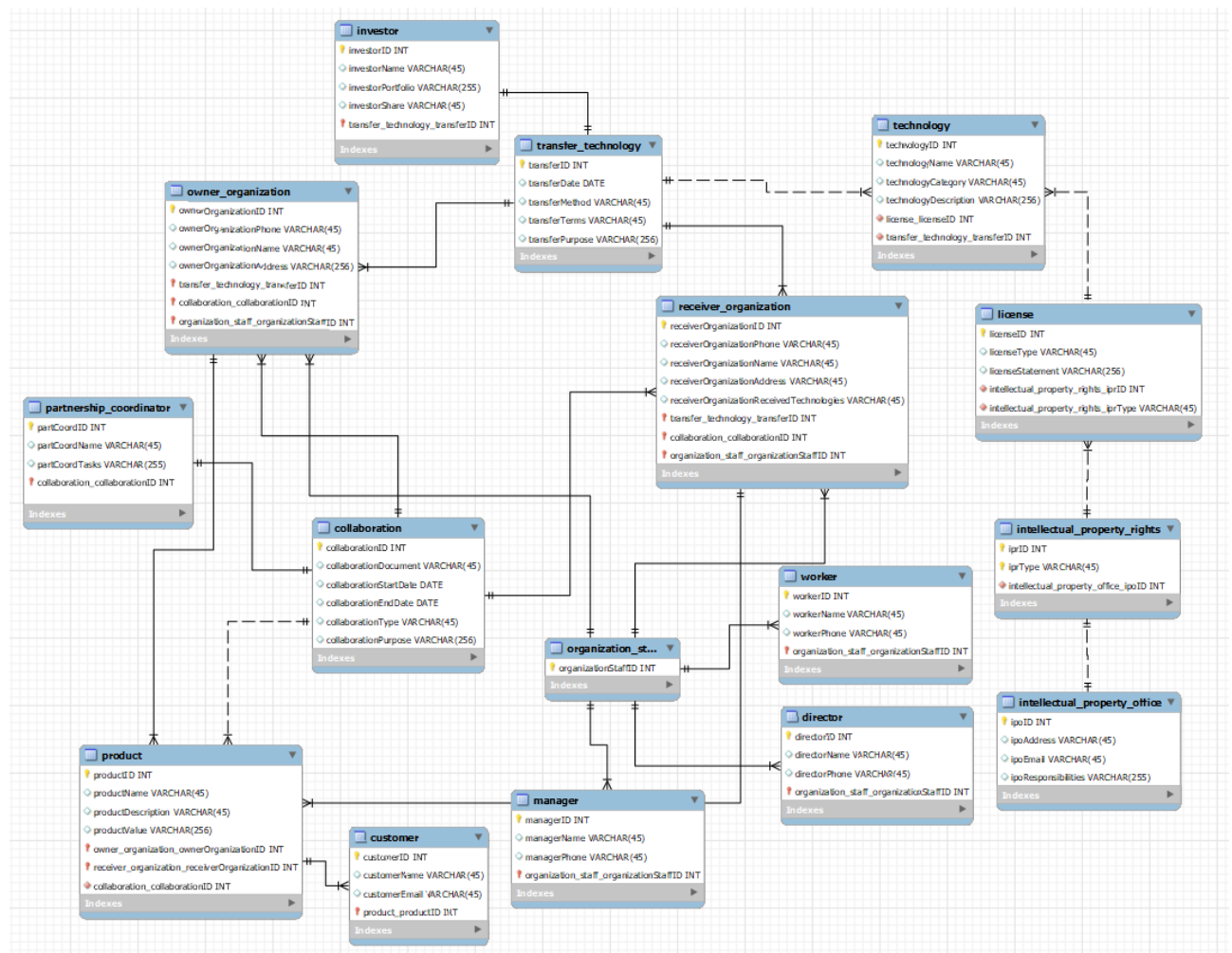
### Refine conceptual model



I have added stakeholders entities with their attributes and made logical connections with my UML diagram

## Step 1.5: Refine your Logical Model and Database (HW2) Based on the Refined Conceptual Model

### Refined Logical Model



Added in same way stakeholders tables for my logical model in MySQL workbench and ran following code

#### Investor table

```
CREATE TABLE IF NOT EXISTS `technology_transfer`.`investor` (  
  `investorID` INT NOT NULL,  
  `investorFirstName` VARCHAR(45) NULL,  
  `investorLastName` VARCHAR(45) NULL DEFAULT NULL,  
  `investorPortfolio` VARCHAR(255) NULL DEFAULT NULL,  
  `investorShare` VARCHAR(45) NULL DEFAULT NULL,  
  `transfer_technology_transferID` INT NOT NULL,  
  PRIMARY KEY (`investorID`, `transfer_technology_transferID`),  
  UNIQUE INDEX `investorID_UNIQUE` (`investorID` ASC) VISIBLE,  
  INDEX `fk_investor_transfer_technology1_idx` (`transfer_technology_transferID` ASC) VISIBLE,  
  CONSTRAINT `fk_investor_transfer_technology1`  
    FOREIGN KEY (`transfer_technology_transferID`)  
      REFERENCES `technology_transfer`.`transfer_technology` (`transferID`))  
ENGINE = InnoDB  
DEFAULT CHARACTER SET = utf8mb4  
COLLATE = utf8mb4_0900_ai_ci;
```

#### Customer table

```
CREATE TABLE IF NOT EXISTS `technology_transfer`.`customer` (  
  `customerID` INT NOT NULL,  
  `customerFirstName` VARCHAR(45) NULL,  
  `customerLastName` VARCHAR(45) NULL DEFAULT NULL,  
  `customerEmail` VARCHAR(45) NULL DEFAULT NULL,  
  `product_productID` INT NOT NULL,  
  PRIMARY KEY (`customerID`, `product_productID`),  
  UNIQUE INDEX `customerID_UNIQUE` (`customerID` ASC) VISIBLE,  
  INDEX `fk_customer_product1_idx` (`product_productID` ASC) VISIBLE,  
  CONSTRAINT `fk_customer_product1`  
    FOREIGN KEY (`product_productID`)  
      REFERENCES `technology_transfer`.`product` (`productID`))  
ENGINE = InnoDB  
DEFAULT CHARACTER SET = utf8mb4  
COLLATE = utf8mb4_0900_ai_ci;
```

## IPO table

```
CREATE TABLE IF NOT EXISTS `technology_transfer`.`intellectual_property_office` (  
  `ipoID` INT NOT NULL,  
  `ipoAddress` VARCHAR(45) NULL DEFAULT NULL,  
  `ipoEmail` VARCHAR(45) NULL DEFAULT NULL,  
  `ipoResponsibilities` VARCHAR(255) NULL DEFAULT NULL,  
  PRIMARY KEY (`ipoID`),  
  UNIQUE INDEX `ipoID_UNIQUE` (`ipoID` ASC) VISIBLE)  
ENGINE = InnoDB  
DEFAULT CHARACTER SET = utf8mb4  
COLLATE = utf8mb4_0900_ai_ci;
```

## Partnership coordinator table (partCoord)

```
CREATE TABLE IF NOT EXISTS `technology_transfer`.`partnership_coordinator` (  
  `partCoordID` INT NOT NULL,  
  `partCoordFirstName` VARCHAR(45) NULL,  
  `partCoordLastName` VARCHAR(45) NULL DEFAULT NULL,  
  `partCoordTasks` VARCHAR(255) NULL DEFAULT NULL,  
  `collaboration_collaborationID` INT NOT NULL,  
  PRIMARY KEY (`partCoordID`, `collaboration_collaborationID`),  
  UNIQUE INDEX `partCoordID_UNIQUE` (`partCoordID` ASC) VISIBLE,  
  INDEX `fk_partnership_coordinator_collaboration1_idx` (`collaboration_collaborationID` ASC) VISIBLE,  
  CONSTRAINT `fk_partnership_coordinator_collaboration1`  
    FOREIGN KEY (`collaboration_collaborationID`)  
    REFERENCES `technology_transfer`.`collaboration` (`collaborationID`))  
ENGINE = InnoDB  
DEFAULT CHARACTER SET = utf8mb4  
COLLATE = utf8mb4_0900_ai_ci;
```

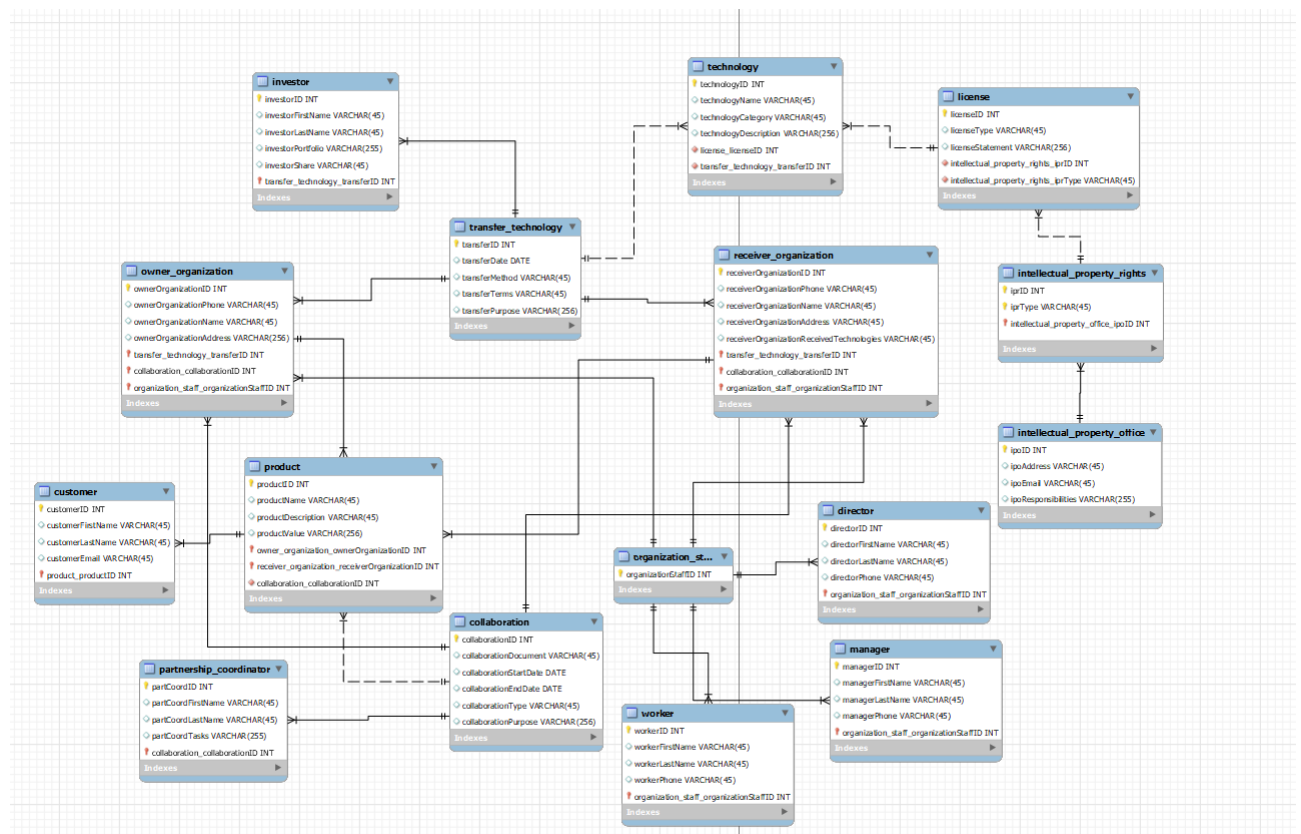
6	23:00:03	CREATE TABLE IF NOT EXISTS `technology_transfer`.`investor` ( `investorID` INT NOT NULL, `investorName` VARCHAR(45) NULL, `investorP...	0 row(s) affected
7	23:00:58	CREATE TABLE IF NOT EXISTS `technology_transfer`.`customer` ( `customerID` INT NOT NULL, `customerName` VARCHAR(45) NULL, `custo...	0 row(s) affected
8	23:01:16	CREATE TABLE IF NOT EXISTS `technology_transfer`.`intellectual_property_office` ( `ipoID` INT NOT NULL, `ipoAddress` VARCHAR(45) NULL, ...	0 row(s) affected
9	23:01:32	CREATE TABLE IF NOT EXISTS `technology_transfer`.`partnership_coordinator` ( `partCoordID` INT NOT NULL, `partCoordName` VARCHAR(45)...	0 row(s) affected

## STEP 1.6: Do Normalization to 3NF

### First Normal Form (1NF):

In 1NF each table cell should contain a single value and each column should contain atomic (indivisible) values. There should be no repeating groups of columns.

To achieve 1NF I will split columns containing multiple values into separate columns, ensuring that each column represents a single attribute of the entity. I have columns with name and I'll divide them into name and surname in order to make more easier access to people and reduce errors to not to think the right order in which to place first and last names.



### Second Normal Form (2NF):

A table is in 2NF if it's in 1NF and every non-key attribute is fully functionally dependent on the entire primary key

In my model it's evident that the second normal form remains intact. Each non-key attribute necessitates the complete primary key for full information. Partial primary key values would result in incomplete data, ensuring adherence to the second normal form.



### Third Normal Form (3NF):

A table is in 3NF if it's in 2NF and every non-prime attribute is non-transitively dependent on the primary key.

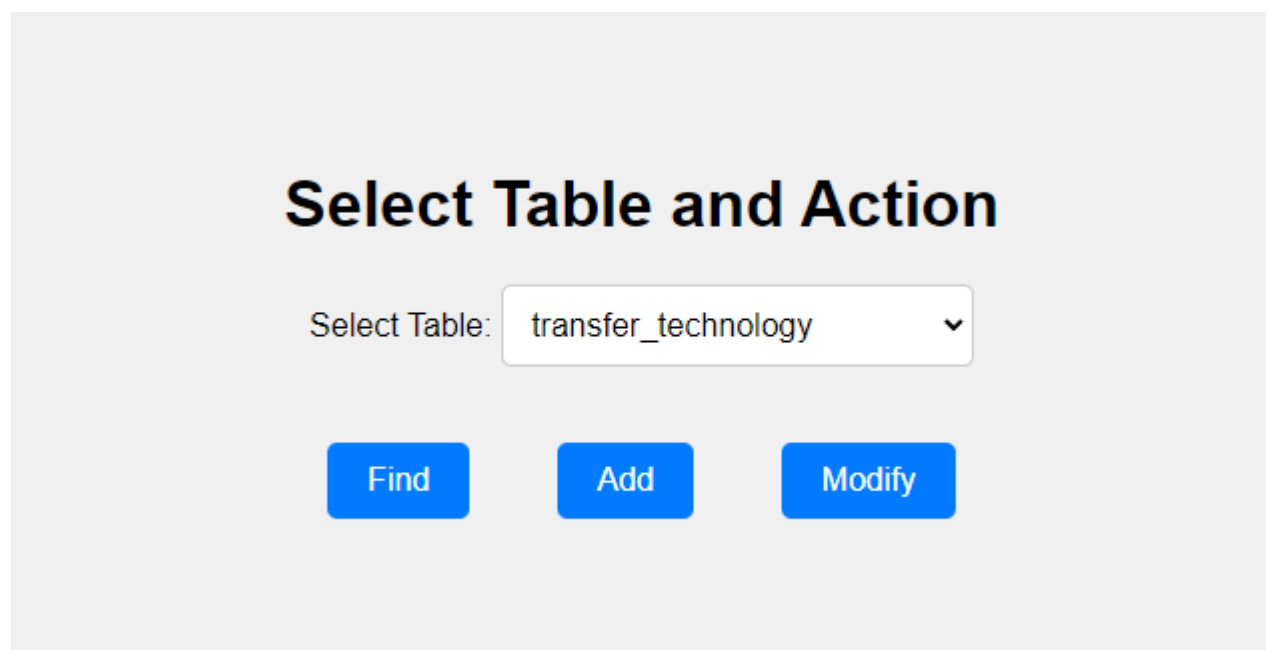
This means that no column should depend on another non-key attribute which in turn depends on another attribute (primary key)

In my model such a dependency is not present. Therefore, there's no need for further modifications to our model. This indicates that we can proceed with using our model after reaching the first normal form (1NF) for subsequent steps because it was logically done in previous homeworks.

I've also have done some changes in model from HW2 namely made every primary key unique to avoid duplicates and errors. To make all these changes (1NF form and uniqueness of primary keys) I've used the forward engineering section in Database in MySQL workbench.

### STEP 1.7: Develop a Software App (3-5 Forms) for Manipulating Data

Next task was to develop software app. I have developed I simple website using Flask in Python. There are 4 functions that it can do: find data, modify data, add data. There are some examples



The screenshot shows a web application interface with a light gray background. At the top, the title "Select Table and Action" is displayed in a large, bold, black font. Below the title, there is a form element labeled "Select Table:" in a smaller black font. To the right of this label is a white dropdown menu with a thin gray border, containing the text "transfer\_technology" and a small downward-pointing arrow icon. Below the dropdown menu, there are three blue rectangular buttons with rounded corners and white text. The buttons are labeled "Find", "Add", and "Modify" from left to right.

## Select Table and Action

Select Table:

transfer\_technology



Find

collaboration  
customer  
director  
intellectual\_property\_office  
intellectual\_property\_rights  
investor  
license  
manager  
organization\_staff  
owner\_organization  
partnership\_coordinator  
product  
receiver\_organization  
technology  
transfer\_technology  
worker

We can find row by its primary key

## Find Record

*Enter the ID of the row to find*

investor ID:

Find Record

We can add row to a table

## Add Record to investor

investorID:

investorFirstName:

investorLastName:

investorPortfolio:

investorShare:

transfer\_technology\_transferID:

Add Record

We can modify row by its indicating primary key

## Modify Record

*Enter the ID of the row to modify. You can modify the fields except for the row ID*

investor ID:

investorFirstName:

investorLastName:

investorPortfolio:

investorShare:

transfer\_technology\_transferID:

Modify Record

Example of adding transfer technology

### Add Record to transfer\_technology

transferID:

17

transferDate:

2024-02-14

transferMethod:

Bank transfer

transferTerms:

Telegraph

transferPurpose:

Developing glasses and procesors for smartphones

Add Record

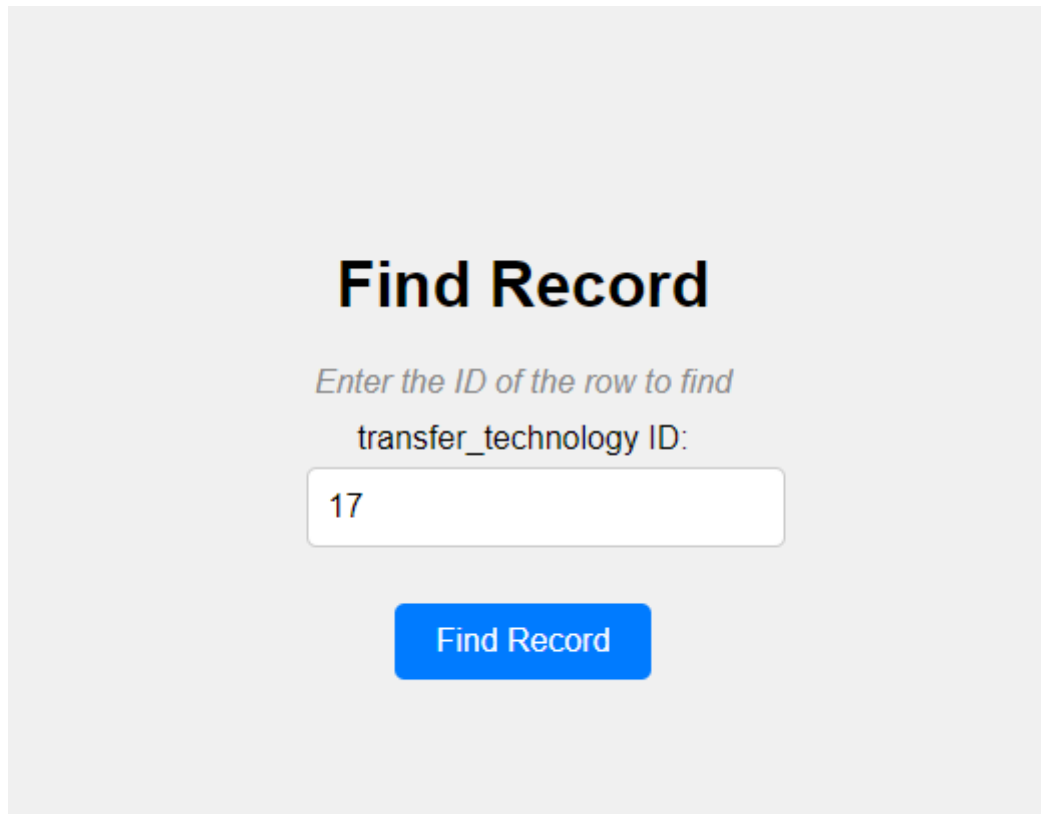
Report and executed query

Record added to transfer\_technology successfully. Executed Query: INSERT INTO transfer\_technology (transferID, transferDate, transferMethod, transferTerms, transferPurpose) VALUES (%s, %s, %s, %s, %s) Values added: ['17', '2024-02-14', 'Bank transfer', 'Telegraph', 'Developing glasses and procesors for smartphones']

17	2024-02-14	Bank transfer	Telegraph	Developing glasses and procesors for smartph...
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## Step 1.8: Develop 3 Reports and Respective Queries. Include in the Software App

We can find by primary key row of transfer technology

A screenshot of a web application interface for finding records. It features a light gray background with a central white area. At the top, the text 'Find Record' is displayed in a large, bold, black font. Below this, a smaller, italicized gray text prompt says 'Enter the ID of the row to find'. Underneath the prompt, the text 'transfer\_technology ID:' is shown. A white input field with a thin gray border contains the number '17'. Below the input field is a blue rectangular button with rounded corners and the text 'Find Record' in white.

### Report and executed query

Record found in transfer\_technology: (17, datetime.date(2024, 2, 14), 'Bank transfer', 'Telegraph', 'Developing glasses and procesors for smartphones') SELECT \* FROM transfer\_technology WHERE transferID = %s

Add record to corresponding table

## Add Record to intellectual\_property\_office

ipoID:

8000

ipoAddress:

InnoPat Office

ipoEmail:

info@innopatoffice.com

ipoResponsibilities:

Specializes in patent-related matters, including patent filing, prosecution, and maintenance.

Add Record

### Report and executed query

Record added to intellectual\_property\_office successfully. Executed Query: INSERT INTO intellectual\_property\_office (ipoID, ipoAddress, ipoEmail, ipoResponsibilities) VALUES ('%s', '%s', '%s', '%s') Values added: ['8000', 'InnoPat Office', 'info@innopatoffice.com', 'Specializes in patent-related matters, including patent filing, prosecution, and maintenance.']

## Modify record

# Modify Record

*Enter the ID of the row to modify. You can modify the fields except for the row ID*

ipoID:

8000

ipoAddress:

InnoPat Corporation

ipoEmail:

info@innopatoffice.com

ipoResponsibilities:

Specializes in patent-related matters, including patent filing, prosecution, and m

Modify Record

### Report and executed query

Record modified in intellectual\_property\_office successfully. UPDATE intellectual\_property\_office SET ipoID = %s, ipoAddress = %s, ipoEmail = %s, ipoResponsibilities = %s WHERE ipoID = %s



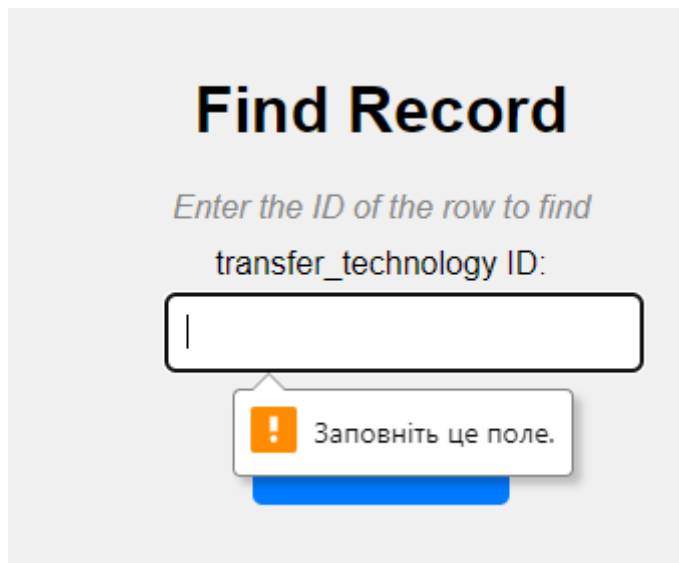
## Step 1.9: Test Your DBS

It handles when it is no such row

### Report and executed query

No record found in transfer\_technology with ID 20

Also null primary keys which should be entered



The image shows a web form titled "Find Record". Below the title is a prompt: "Enter the ID of the row to find transfer\_technology ID:". There is a text input field with a cursor. Below the input field is a validation error message in a white box with an orange exclamation mark icon: "Заповніть це поле." (Fill in this field.).

Incorrect datatypes

### Error

Error adding record to transfer\_technology: 1292 (22007): Incorrect date value: '15.02.2024' for column 'transferDate' at row 1

Duplicated adding rows with same primary keys are also handled

### Error

Error adding record to intellectual\_property\_office: 1062 (23000): Duplicate entry '8000' for key 'intellectual\_property\_office.PRIMARY'

## Conclusion

In this assignment, I followed a structured methodology to develop a database system. The report outlines various tasks aimed at achieving specific goals. Starting with defining the mission and objectives of the DBS, I proceeded to gather requirements and create external views using UML class diagrams. These views helped visualize the system entities and relationships. Refining the conceptual model led to a detailed logical model, which was then normalized to ensure database efficiency and integrity.

Using Python and Flask, I developed a user interface to interact with the DBS, allowing for data manipulation and operations. Additionally, I created reports and queries integrated into the application. Thorough testing was conducted to validate the DBS's functionality, performance, and data integrity, ensuring any issues were addressed.

It showcases understanding of database systems concepts, requirements elicitation, modeling, normalization, software development, and testing. The result is a functional DBS aligned with the specified mission and objectives.

Code for database - [https://github.com/Baredal/database\\_technology\\_transfer](https://github.com/Baredal/database_technology_transfer)