系统设计模型

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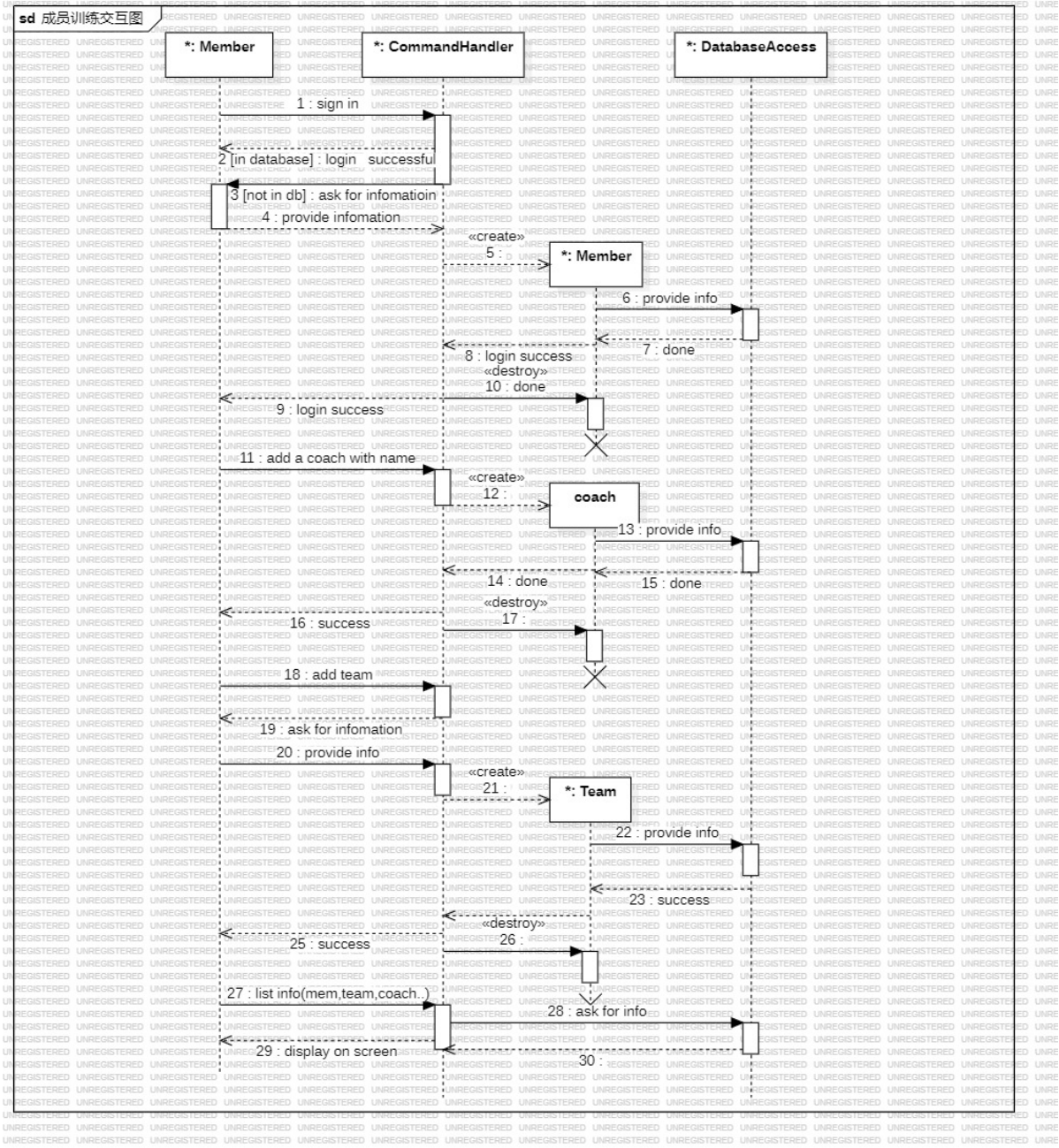
3. 设计

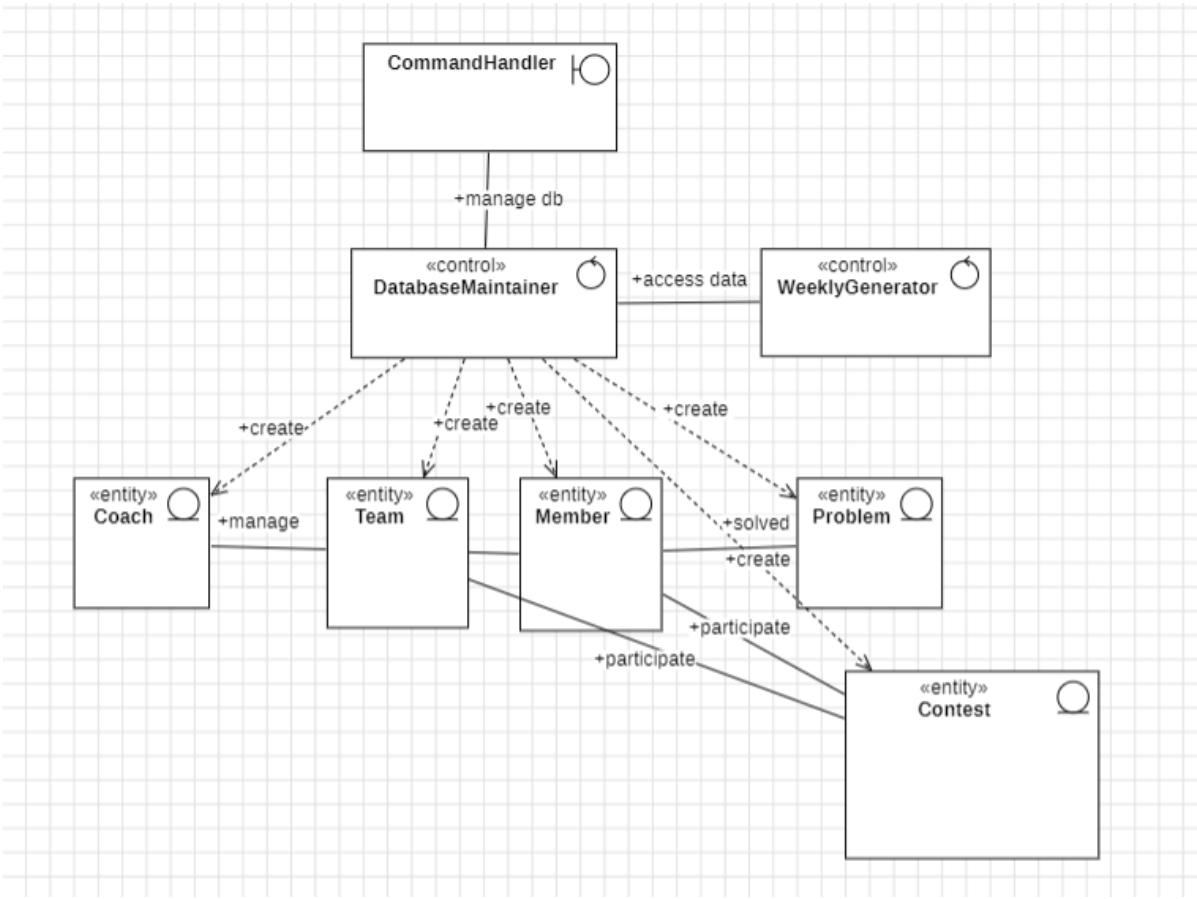
3.1 对象设计

交互图：

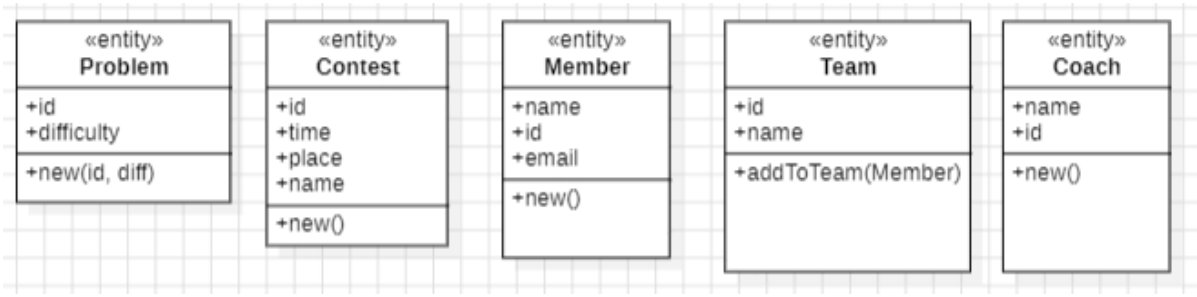


设计类图：

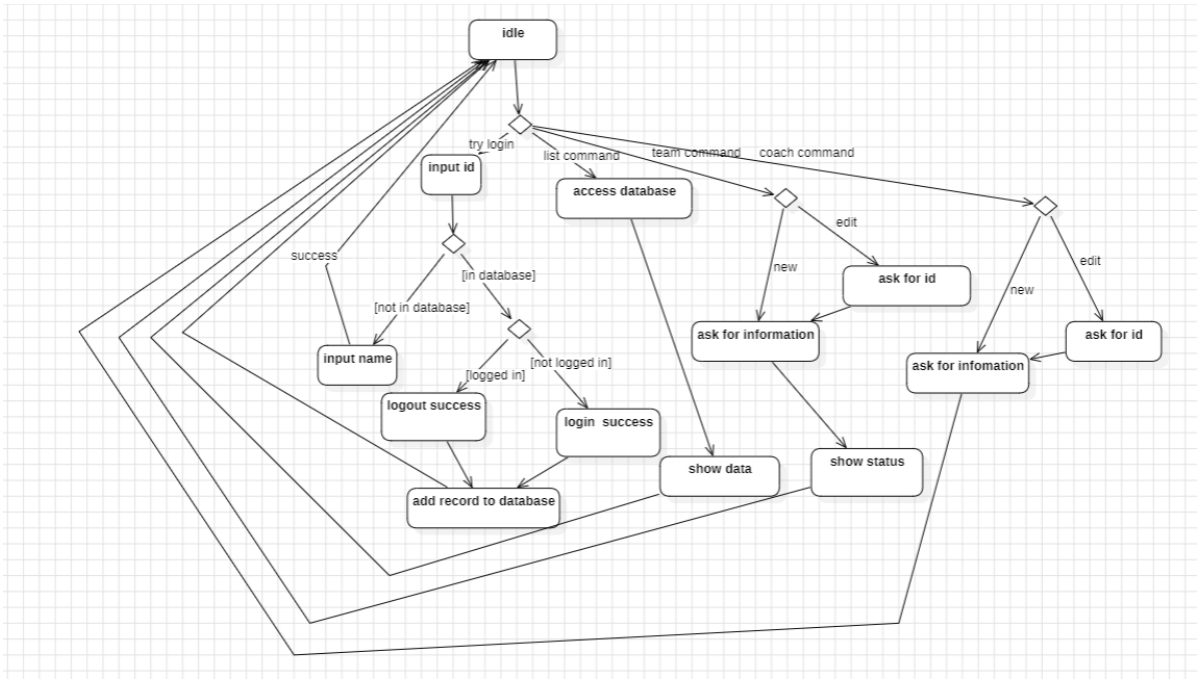
概要类图，分为三个层次，最上面的是UI类，下面的是业务层，最小面的是实体和数据库访问类。



关键类详细设计：



状态图：重要对象的状态机



3.2 用户界面设计

实现的语言： **Rust语言**，因为 `rust` 的效率很高，运行开销小，而且是跨平台的，在不同的系统下编译即可。还有一点最重要的是 `rust` 内部编码就是 `UTF-8` 这让用 `rust` 编写的程序能很轻易的支持中文的输入、输出和处理，不用担心乱码的问题。

界面原型：因为我的这个系统需要放在集训室的服务器上在命令行运行，所以只实现了命令行界面，但是尽可能在命令行界面下实现的简单易用，我使用了 `rustyline` 库，使得用户可以像与 `shell` 交互一样与集训队管理系统交互。

```
未检测到数据库文件，开始初始化系统
集训队名称：NWU_ACM_ICPC
初始化成功！
数据将储存在工作目录下的 system_db 中，请勿删除或移动该文件！
NWU_ACM_ICPC>> 2021117405
未找到该学号，是否创建成员[Y,n]
请输入姓名：孙潇桐
成员创建成功，再次输入学号即可登录
NWU_ACM_ICPC>> 2021117405
孙潇桐同学，签到成功！
NWU_ACM_ICPC>> 2021117406
未找到该学号，是否创建成员[Y,n]
请输入姓名：顺序图
成员创建成功，再次输入学号即可登录
NWU_ACM_ICPC>> 2021117407
未找到该学号，是否创建成员[Y,n]
请输入姓名：是夏天
成员创建成功，再次输入学号即可登录
NWU_ACM_ICPC>> list members
+------------+--------+--------------------------------+
| ID         | Name   | Join Time                      |
+------------+--------+--------------------------------+
| 2021117405 | 孙潇桐 | 2023-12-10 13:08:02.728126600 |
+------------+--------+--------------------------------+
| 2021117406 | 顺序图 | 2023-12-10 13:08:15.814775200 |
+------------+--------+--------------------------------+
| 2021117407 | 是夏天 | 2023-12-10 13:08:25.775224500 |
+------------+--------+--------------------------------+
NWU_ACM_ICPC>> 2021117405
孙潇桐同学，签退成功！本次训练 0 小时 3 分钟
NWU_ACM_ICPC>> 2021117406
顺序图同学，签到成功！
NWU_ACM_ICPC>> list login
+------------+--------+--------------------------------+
| ID         | Name   | Login Time                     |
+------------+--------+--------------------------------+
| 2021117406 | 顺序图 | 2023-12-10 13:12:11.696835700 |
+------------+--------+--------------------------------+
NWU_ACM_ICPC>>
```

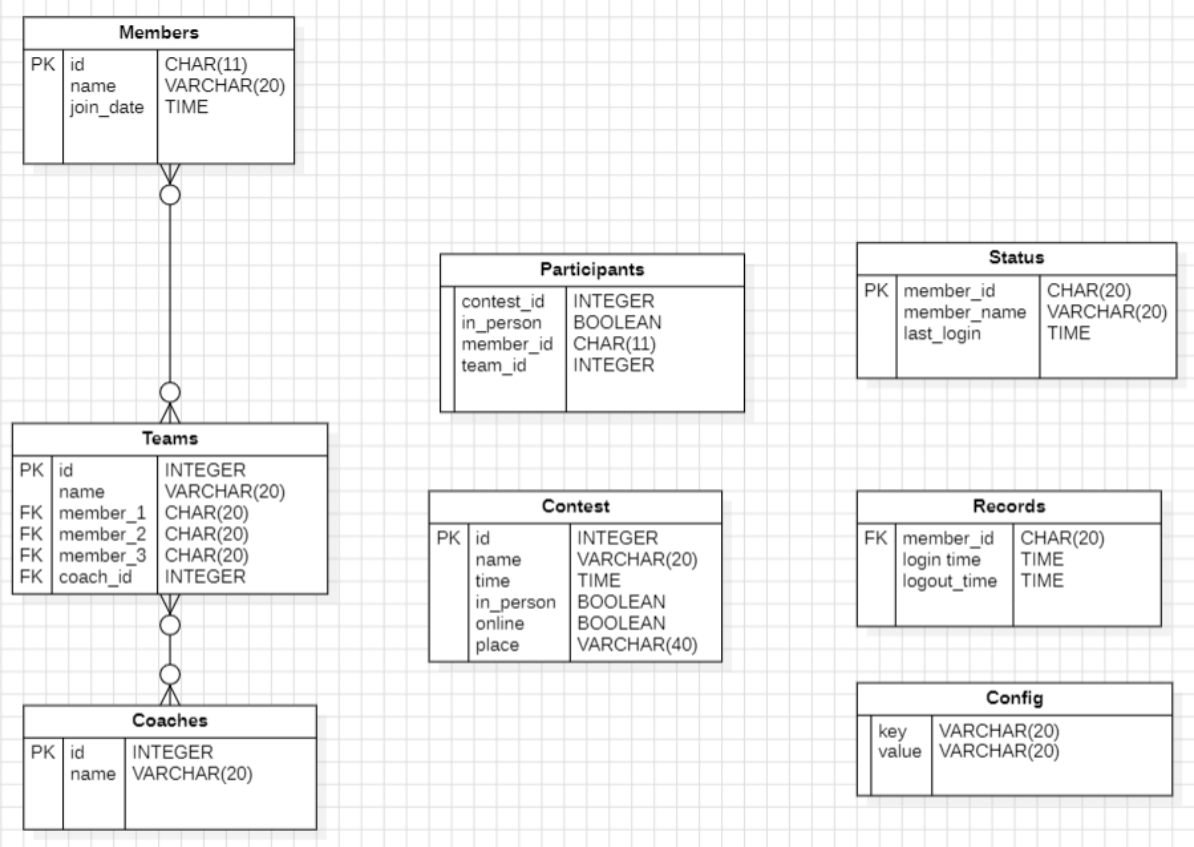
```
NWU_ACM_ICPC>> coach add
请输入教练名称：数学题
NWU_ACM_ICPC>> list coach
Invalid command. Try input 'list help' to get help.
NWU_ACM_ICPC>> list coaches
+----------+------------+
| Coach ID | Coach Name |
+----------+------------+
| 1        | 是系统     |
+----------+------------+
| 2        | 数学题     |
+----------+------------+
NWU_ACM_ICPC>> coach edit 1
请输入教练名称：是夏天
1, 是夏天
NWU_ACM_ICPC>> list coach
Invalid command. Try input 'list help' to get help.
NWU_ACM_ICPC>> list coaches
+----------+------------+
| Coach ID | Coach Name |
+----------+------------+
| 1        | 是夏天     |
+----------+------------+
| 2        | 数学题     |
+----------+------------+
NWU_ACM_ICPC>>
```

```
NWU_ACM_ICPC>> team add
Please input the team info:
团队名称：团队
队员一学号：2021117405
队员二学号：2021117406
队员三学号：2021117407
教练id：1
NWU_ACM_ICPC>> list teams
+---------+-----------+-------------+-------------+-------------+----------+
| Team ID | Team Name | Member_1 ID | Member_2 ID | Member_3 ID | Coach ID |
+---------+-----------+-------------+-------------+-------------+----------+
| 1       | 团队      | 2021117405  | 2021117406  | 2021117407  | 1        |
+---------+-----------+-------------+-------------+-------------+----------+
NWU_ACM_ICPC>> team edit 1
Please input the team info:
团队名称：动态
队员一学号：2021117407
队员二学号：2021117406
队员三学号：2021117405
教练id：2
NWU_ACM_ICPC>> list teams
+---------+-----------+-------------+-------------+-------------+----------+
| Team ID | Team Name | Member_1 ID | Member_2 ID | Member_3 ID | Coach ID |
+---------+-----------+-------------+-------------+-------------+----------+
| 1       | 动态      | 2021117407  | 2021117406  | 2021117405  | 2        |
+---------+-----------+-------------+-------------+-------------+----------+
NWU_ACM_ICPC>>
```

3.3 数据库设计

为了方便移动，使用的是 `sql lite` 数据库，将数据储存在工作目录下的 `system_db` 中，使用了 `rusqlite` 库与数据库交互。

ER图：



数据库访问类：我对带有 `SQL` 语句的操作都进行了包装，都放在了 `database_access` 模块中，在业务层都是完全面向对象的。

下面是：`database_access.rs`

```
use super::entities::*;
use chrono::{Local, NaiveDateTime};
use rusqlite::Error;
use rusqlite::{params, Connection};

pub fn init_db(name: String, connection: &Connection) -> Result<(), Error> {
    connection.execute(
        "CREATE TABLE Config (
            key VARCHAR(20),
            value VARCHAR(20)
        )",
        params![],
    )?;
    connection.execute(
        "INSERT INTO Config (key,value) VALUES (?1,?2)",
        ["training_squad_name".to_string(), name],
    )?;
    connection.execute(
        "CREATE TABLE Members(
             id         CHAR(11) PRIMARY KEY,
             name       VARCHAR(20),
```

```
            join_time DATETIME
        );",
        params![],
    )?;
    connection.execute(
        "CREATE TABLE Teams(
                id       INTEGER PRIMARY KEY AUTOINCREMENT,
                name     VARCHAR(20),
                member_1 CHAR(20),
                member_2 CHAR(20),
                member_3 CHAR(20),
                coach_id INTEGER
        )",
        [],
    )?;
    connection.execute(
        "CREATE TABLE Contests(
                id        INTEGER PRIMARY KEY AUTOINCREMENT,
                name      VARCHAR(20),
                time      DATETIME,
                in_person BOOLEAN,
                online    BOOLEAN,
                place     VARCHAR(40)
        )",
        [],
    )?;
    connection.execute(
        "CREATE TABLE Coaches(
            id   INTEGER PRIMARY KEY AUTOINCREMENT,
            name VARCHAR(20)
        )",
        [],
    )?;
    connection.execute(
        "CREATE TABLE Participants(
            contest_id INTEGER,
            in_person  BOOLEAN,
            member_id  CHAR(11),
            team_id    INTEGER
        )",
        [],
    )?;
    connection.execute(
        "CREATE TABLE Status(
            member_id  CHAR(20) PRIMARY KEY,
            member_name VARCHAR(20),
            last_login DATETIME
        );",
        [],
    )?;
    connection.execute(
        "CREATE TABLE Records(
            member_id   CHAR(11),
            login_time  DATETIME,
            logout_time DATETIME
        )",
```

```
        [],
    )?;

    // connection.execute(
    //     "",
    //     [],
    // )?;
    Ok(())
}

pub fn add_member(connection: &Connection, member: &Member) -> Result<(), Error>
{
    let [id, name] = member.to_arr();
    connection.execute(
        "INSERT INTO Members
        VALUES (?1, ?2, ?3)",
        [id, name, &Local::now().naive_local().to_string()],
    )?;
    connection.execute(
        "INSERT INTO Status
        VALUES (?1, ?2, NULL)",
        [id, name],
    )?;
    Ok(())
}

pub fn log_in_or_out(connection: &Connection, member: &Member) -> Result<(),
Error> {
    let [id, name] = member.to_arr();
    match connection.query_row(
        "SELECT last_login FROM Status WHERE member_id = ?1",
        [id],
        |row| row.get(0),
    ) {
        Ok(time) => {
            let time: String = time;
            let last_login = NaiveDateTime::parse_from_str(&time, "%Y-%m-%d
%H:%M:%S%.f").unwrap();
            let current_time = Local::now().naive_local();
            let time_difference = current_time.signed_duration_since(last_login);
            let hours = time_difference.num_hours();
            let minutes = time_difference.num_minutes() % 60;
            connection.execute(
                "UPDATE Status SET last_login = NULL WHERE member_id = ?1",
                [id],
            )?;
            connection.execute(
                "INSERT INTO Records VALUES (?1, ?2, ?3)",
                [id, &time, &current_time.to_string()],
            )?;
            println!("{name}同学，签退成功！本次训练 {hours} 小时 {minutes} 分钟");
        }
        Err(_) => {
            connection.execute(
                "UPDATE Status SET last_login = ?1 WHERE member_id = ?2",
                [&Local::now().naive_local().to_string(), id],
```

```
            )?;
            println!("{name}同学，签到成功！");
        }
    }
    Ok(())
}

pub fn query_member(connection: &Connection, id: &String) -> Result<Member,
Error> {
    let (id, name) =
        connection.query_row("SELECT id, name FROM Members WHERE id = ?1", &[id],
|row| {
            Ok((row.get(0)?, row.get(1)?))
        })?;
    Ok(Member::new(&id, &name))
}

pub fn get_squad_name(connection: &Connection) -> Result<String, Error> {
    let name: String = connection.query_row(
        "SELECT value FROM Config WHERE key = 'training_squad_name'",
        [],
        |row| row.get(0),
    )?;
    Ok(name)
}

pub fn get_members(conn: &Connection, get_login: bool) -> Result<Vec<Member>,
Error> {
    let sql = match get_login {
        true => {
            "SELECT member_id, member_name, last_login FROM Status WHERE
last_login IS NOT NULL"
        }
        false => "SELECT id, name, join_time FROM Members",
    };
    let mut stmt = conn.prepare(sql)?;
    let member_iter = stmt.query_map([], |row| {
        Ok(Member::new_with_time(
            &row.get(0)?,
            &row.get(1)?,
            &row.get(2)?,
        ))
    })?;
    let members: Vec<Member> = member_iter.filter_map(Result::ok).collect();
    Ok(members)
}
pub fn get_teams(conn: &Connection) -> Result<Vec<Team>, Error> {
    let sql = "SELECT id, name, member_1, member_2, member_3, coach_id FROM
Teams";
    let mut stmt = conn.prepare(sql)?;
    let team_iter = stmt.query_map([], |row| {
        Ok(Team::new(
            row.get(0)?,
            row.get(1)?,
            row.get(2)?,
            row.get(3)?,
```

```
            row.get(4)?,
            row.get(5)?,
        ))
    })?;
    let teams: Vec<Team> = team_iter.filter_map(Result::ok).collect();
    Ok(teams)
}

pub fn add_team(conn: &Connection, team: &Team) -> Result<(), Error> {
    let sql = "INSERT INTO Teams(name, member_1, member_2, member_3, coach_id)
VALUES (?1, ?2, ?3, ?4, ?5)";
    conn.execute(sql, team.to_arr_without_id())?;
    Ok(())
}

pub fn update_team(conn: &Connection, team: &Team) -> Result<(), Error> {
    let sql = "UPDATE Teams SET name = ?1, member_1 = ?2, member_2 = ?3, member_3
= ?4, coach_id = ?5 WHERE id = ?6";
    conn.execute(sql, team.to_arr())?;
    Ok(())
}

pub fn get_coaches(conn: &Connection) -> Result<Vec<Coach>, Error> {
    let sql = "SELECT id, name FROM Coaches";
    let mut stmt = conn.prepare(sql)?;
    let coach_iter = stmt.query_map([], |row| Ok(Coach::new(row.get(0)?,
row.get(1)?)))?;
    let coaches: Vec<Coach> = coach_iter.filter_map(Result::ok).collect();
    Ok(coaches)
}

pub fn add_coach(conn: &Connection, coach_name: &String) -> Result<(), Error> {
    let sql = "INSERT INTO Coaches(name) VALUES (?1)";
    conn.execute(sql, [coach_name])?;
    Ok(())
}

pub fn update_coach(conn: &Connection, coach: &Coach) -> Result<(), Error> {
    let sql = "UPDATE Coaches SET name = ?1 WHERE id = ?2";
    conn.execute(sql, coach.to_arr())?;
    Ok(())
}

#[cfg(test)]
mod tests {
    use rusqlite::{Connection, OpenFlags};

    use crate::database_access::get_members;
    #[allow(dead_code)]
    fn get_connection() -> Connection {
        Connection::open_with_flags(
            "system_db",
            OpenFlags::SQLITE_OPEN_READ_WRITE | OpenFlags::SQLITE_OPEN_CREATE,
        )
        .unwrap()
    }
```

```
    #[allow(dead_code)]
    #[test]
    fn test_query() {
        let conn = get_connection();
        println!("{:?}", get_members(&conn, true));
        // println!("{}", chrono::Local::now().date_naive().to_string())
    }
}
```