Web searchable database for exercise

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ABSTRACT

Exercise has numerous benefits including but not limited to increase in life expectancy, stress relief, depression management, improved sleep and weight control. As schedules become increasingly busy, time and commitment to fitness is more important but more difficult to maintain. Access to a web searchable database that can provide information about exercise options, gym locations and class times, and calorie burn can help them plan their exercise routines. The goal of this project is to create a web accessible and searchable database for possible exercise routines, including number of calories burned with each activity. This should also help maintain details of gym, instructors, exercises (benefits and calories burned), and equipment (availability in each facility). The system will be developed using MySQL for database management. PHP will be used to create the web interface, pull and maintain data from the database and logically display it to the end user using HTML, CSS, Javascript, etc. The outcome of this project will be a web searchable database which will maintain details of gym facilities, members, equipment, instructor, exercises, weight and unit calories burned. This system will allow addition, deletion, modification and search of the data. It will also provide a calorie calculator which will help people know the calories they would burn with each activity in gym so that they can analyze the effects of their routine exercise and modify those if needed.

INTRODUCTION

In 2015, nearly one in three adult Americans was considered overweight, and an additional one-third of adult Americans was considered obese (Flegal et al., 2016). Additionally, one in six children and adolescents between the ages of 2-19 were considered overweight. Consequences of being overweight or obese include type II diabetes, high blood pressure, heart disease, arthritis, sleep apnea, cancer, and even premature death (Ogden et al., 2016). Weight control can be achieved through dietary restriction as well as physical activity. However, many people may not know what exercise regimens to follow or where to go for specific types of exercise.

The first documentation of a recommendation for an exercise regimen dates to 400 BC from Hippocrates, and can be found in the American College of Sports Medicine Health and Physical Activity Database (www.acsm.org). Web-based or smartphone applications to aid in tracking diet and exercise are abundant today, and include such programs as: MyFitnessPal, Lose it!, Fooducate, My Food Diary, and others (Whiteman, 2017). These programs are especially appealing because they are easy to access, offer privacy, are cost effective (often free), and do not require users to attend meetings or doctor's visits for use. In a study in the UK in 2013, 128 overweight volunteers used either a web-based application, smartphone application, or paper diary as a tool for weight management and intervention over the course of 6 months. Retention in the study and adherence to the weight management program was significantly higher in patients who used the web-based or smartphone app as compared to those using the paper diary. Further, weight loss and reduction in BMI was better in individuals using the application compared to those using the paper diary (Carter et al., 2013). A meta-analysis of studies comprising over 11,000 patients showed that web-based therapies for weight loss result in improved outcomes for patients in the areas of knowledge and behavior change (Wantland et al., 2004). Importantly, weight loss maintenance over the course of 18-months, participation in healthcare, knowledge of nutritional status, and increased exercise time were all improved in patients using web-based applications versus those using non-web-based strategies (Wantland et al., 2004).

The majority of web-based applications for weight maintenance and exercise are national or international in their scope, and so do not focus on resources in a specific area. A web search for "Indianapolis exercise" yielded over 33 million hits, most of which are individual gyms or fitness centers. However, there is no available database that combines the multitude of gym, fitness center, and outdoor options for exercise in the greater Indianapolis area. For individuals who are new to the area, and for whom exercise and fitness is important, the task of finding the right gym with the right classes could be extremely onerous. Thus, our database will compile this information into one, easily-accessible website, so users do not need to search each gym individually.

The benefit of exercise is clear, and the use of web-based management tools has been shown in many studies. Depending on location, availability of gym facilities versus outdoor options varies. Outdoor exercise provides additional health benefits, particularly in terms of exposure to vitamin D, which is known to play a role in cancer prevention, bone health, as well as both immune and mental health (Grant and Holick, 2005). To fully promote a healthy lifestyle, our database will also include options for outdoor walking or hiking trails, easily searchable along with the gym and fitness center information.

DATA

The data will be collected from different resources for all the attributes mentioned in the ER diagram as all this data cannot be obtained from one common source. In case, we do not get data for a particular attribute, it will be self created, considering that the goal of our project is how well we can implement the web development module rather than collecting legitimate data. For example, the data for members of gym, instructors, their exercise plans and all the personal information will not be available for publicly. This data will be self created for the sole purpose of using it for the project implementation.

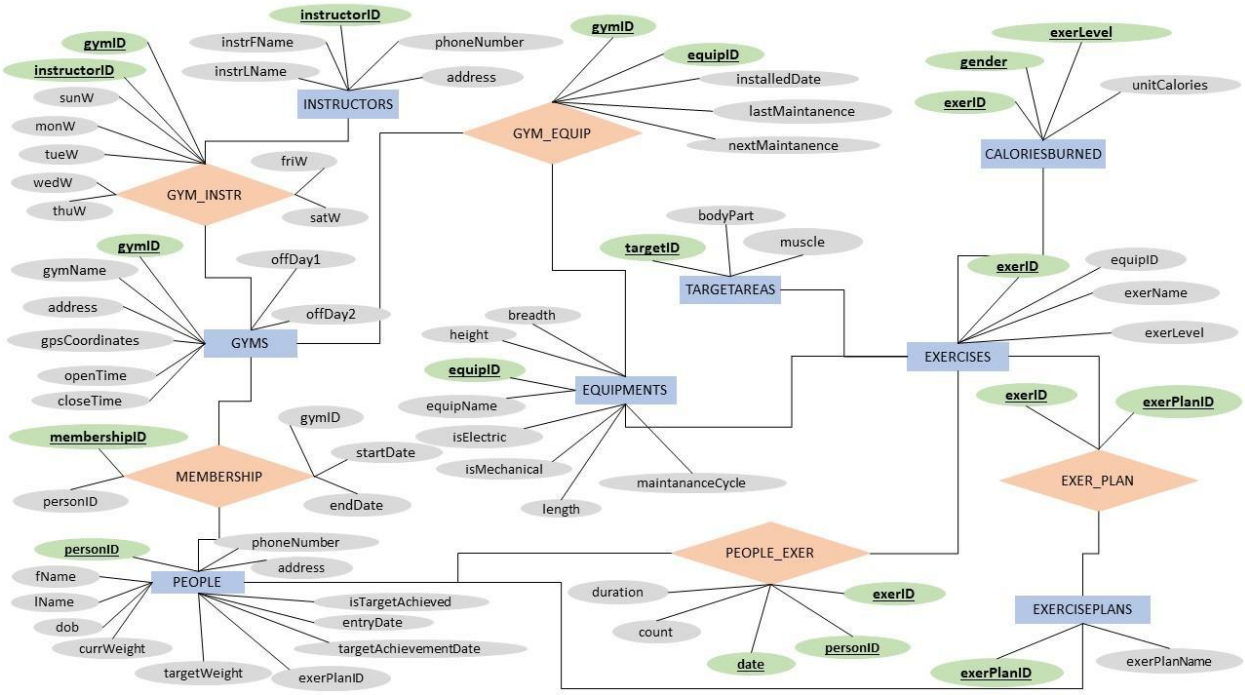
Some of the websites that will be used for collecting the data for entity and relationship are as follows

1. Calories burnt with Activity/Exercise
   https://www.health.harvard.edu/diet-and-weight-loss/calories-burned-in-30-minutes-of-leisure-and-routine-activities
2. Target Areas
   https://www.jefit.com/routines/workout-routine-database.php?id=25371
3. Equipments
   http://www.marforres.marines.mil/Portals/116/Docs/MCCS/SemperFit/Docs/Fitness/Gym_Equipment_Descriptions.pdf
4. Exercises
   https://www.jefit.com/routines/workout-routine-database.php?id=25371

All this data will be collected and maintained in an excel file which will be used for the database.

METHODS

Entity Relationship Diagram



GREEN primary key attribute/s GRAY non-key attributes BLUE entities ORANGE relationship

Figure 1 : Entity Relationship Diagram

Database Design Language(DBDL)

Entity tables

1. gyms(**gymID**, gymName, address, gpsCoordinates, openTime, closeTime, offDay1, offDay2)
2. equipments(**equipID**, equipName, isElectric, isMechanical, maintananceCycle, length, breadth, height)
3. targetAreas(**targetID**, bodyPart, muscle)
4. exercises(**exerID**, exerName, equipID, exerLevel, targetID)

FK targetID -> targetArea

FK equipID -> equipments

5. exercisePlans(**exerPlanID**, exerPlanName)
6. caloriesBurned(**exerID, gender, exerLevel**, unitCalories)

FK exerID -> exercises

7. instructors(**instructorID**, instrFName, instrLName, phoneNumber, address)
8. people(**personID**, fNname, lName, phoneNumber, address, dob, currWeight, targetWeight, exerPlanID, entryDate, isTargetAchieved, targetAchievementDate)

FK exerPlanID -> exercisePlans

Relationship tables

1. gym_equip(**gymID, equipID**, installedDate, lastMaintanence, nextMaintenance)

FK gymID -> gyms

FK equipID -> equipments

2. gym_instr(**gymID, instructorID**, sunW, monW, tueW, wedW, thuW, friW, satW)

FK gymID -> gyms

FK instructorID -> instructors

3. membership(**membershipID**, personID, gymID, startDate, endDate)

FK personID -> people

FK gymID -> gyms

4. people_exer(**personID, exerID, date**, duration, count)

FK personID -> people

FK exerID -> exercises

5. exer_plan(**exerPlanID, exerID**)

FK exerID -> exercises

FK exerPlanID -> exercisePlan

Explanation of the database design:

This database design is close to a 3rd normal form. The design covers most of the aspects of an exercise database. This design has eight entities coloured blue. The relationships between the entities are described below:

Table 1 : Explanation of database design

Sr#	Entity 1	Entity 2	Cardinality	Comments

1	Gyms	Equipments	Many to Many	A gym can have many equipments and a type of equipment can be present in multiple gyms.
2	Gyms	Instructors	Many to Many	A gym can have multiple instructors. An instructor can work at multiple gyms.
3	People	Gyms	Many to Many	A person may be a member of multiple gym facilities and a gym may have more than one members.
4	People	Exercises	Many to Many	A person may do multiple exercises and an exercise may be done by multiple people.
5	Exercises	ExercisePlans	Many to Many	An exercise can be a part of multiple exercise plans. An exercise plan may have more than one exercise.
6	Exercises	Equiments	Many to One	A given exercise can be done on one equipment. An equipment may facilitate multiple exercises on them.
7	Exercises	CaloriesBurned	One to Many	An exercise can have multiple entries of burned calories based on speed or resistance on an equipment.
8	People	ExercisePlans	Many to One	A person may have one exercise plan. An exercise plan may be shared by multiple people.

9	Exercises	TargetAreas	Many to One	An exercise can have a target area but a target area may be same for multiple exercises.

We can keep record of below data in this database:

- The different gym facilities and their details
- Instructors and their schedules. Also maintains which instructor works at which gym on which days
- Keeps a list of equipments commonly used in gyms along with which gym has which equipment options
- Notes the maintenance schedules of various equipment, dimensions and power requirements of each equipment
- List of people, their membership with gyms along with target weight and exercise plan details
- List of exercises, calories burned with each of them, target area of each exercise
- People can keep a track of each exercise they perform along with duration or count and keep track of their exercise plan
- The above details can be inserted, deleted and viewed by users

Web Application Structure

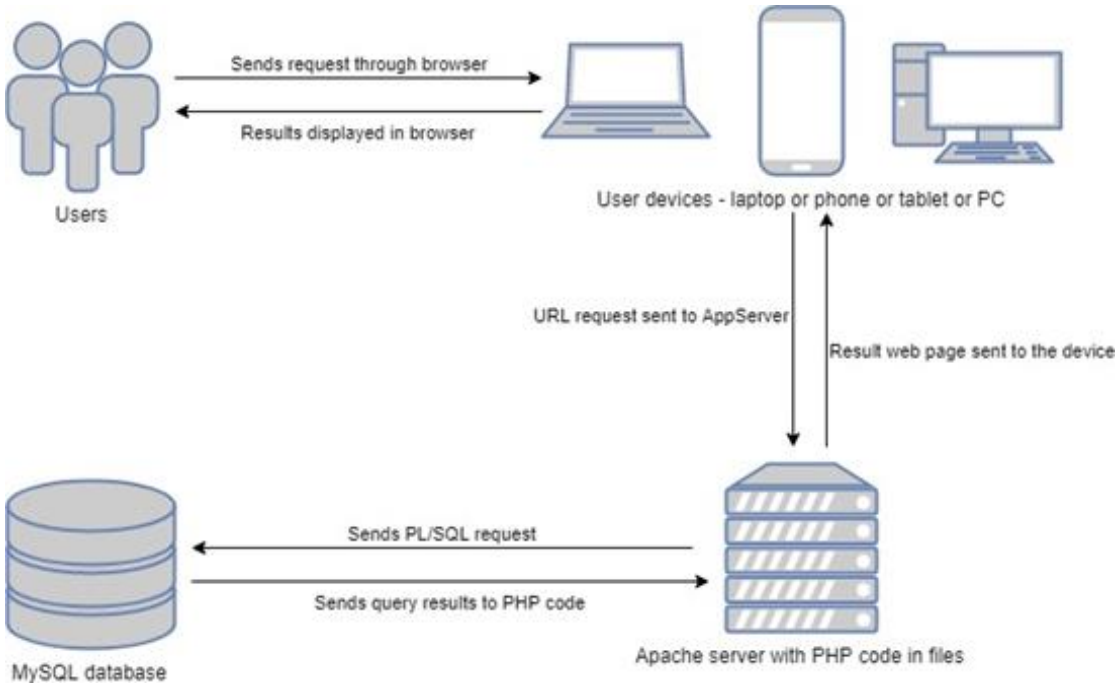


Figure 2 : Web Application Structure

The architecture of the web database for exercise project is described in the image below. It comprises of four major components, users, browsers, middleware and a database.

1. Users:

Users are the end users of the product developed at the end of this project. These are the people who will search and update data in the website created for exercises. This group will typically be system admins who update data for users and share information regarding their exercise routine with users upon request.

2. Browsers:

Since the application developed is a web application, only a browser on mobile phone, tablets, laptops, personal computers would be needed to access the web application over internet.

3. Middleware:

The middleware would mainly consist of Apache server which would contain the PHP files. These files will hold the code to display the web pages and also request data from database or render data received from the database in a well formatted way. These files contain the code to connect to database as well.

4. Database:

The database used in this web application is MySQL. WAMP is used for ease of accessing the database. MySQL includes components such as the InnoDB storage engine that adhere closely to the ACID model, so that data is not corrupted and results are not distorted by exceptional conditions such as software crashes and hardware malfunctions. When you rely on ACID-compliant features, you do not need to reinvent the wheel of consistency checking and crash recovery mechanisms.

Atomicity: Atomicity requires that each transaction be "all or nothing": if one part of the transaction fails, then the entire transaction fails, and the database state is left unchanged. An atomic system must guarantee atomicity in each and every situation, including power failures, errors and crashes.

Consistency: The consistency property ensures that any transaction will bring the database from one valid state to another. Any data written to the database must be valid according to all defined rules, including constraints, cascades, triggers, and any combination thereof.

Isolation: The isolation property ensures that the concurrent execution of transactions results in a system state that would be obtained if transactions were executed sequentially, i.e., one after the other. Providing isolation is the main goal of concurrency control.

Durability: The durability property ensures that once a transaction has been committed, it will remain so, even in the event of power loss, crashes, or errors. In a relational database, for instance, once a group of SQL statements execute, the results need to be stored permanently (even if the database crashes immediately thereafter).

RESULTS

The results displays all the front end web pages that are designed using WAMP, which is a software that includes PHP-Apache-MySQL for linking database to front end.

Below is the home page of the web searchable database. This page has links to all the pages in the application.

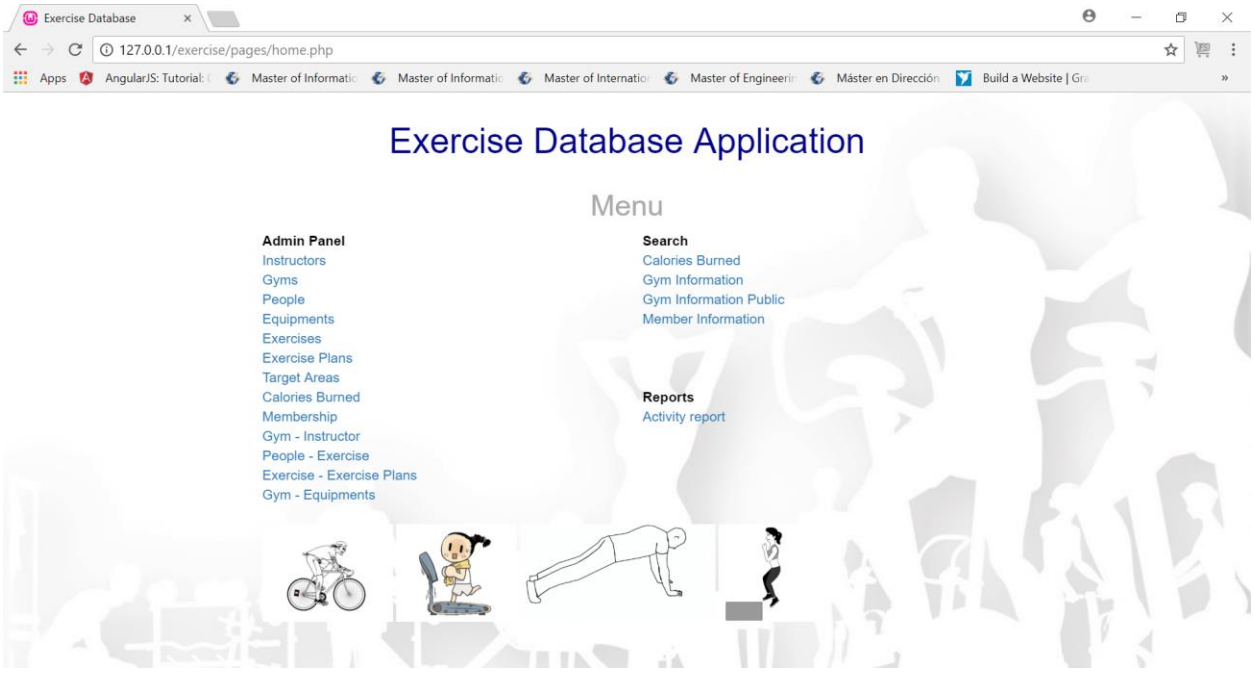


Figure 3 : Main Homepage

Below are the screenshots of the pages prepared so far for insert, update, delete operations on all tables. This comprises of the Admin Panel of the application.

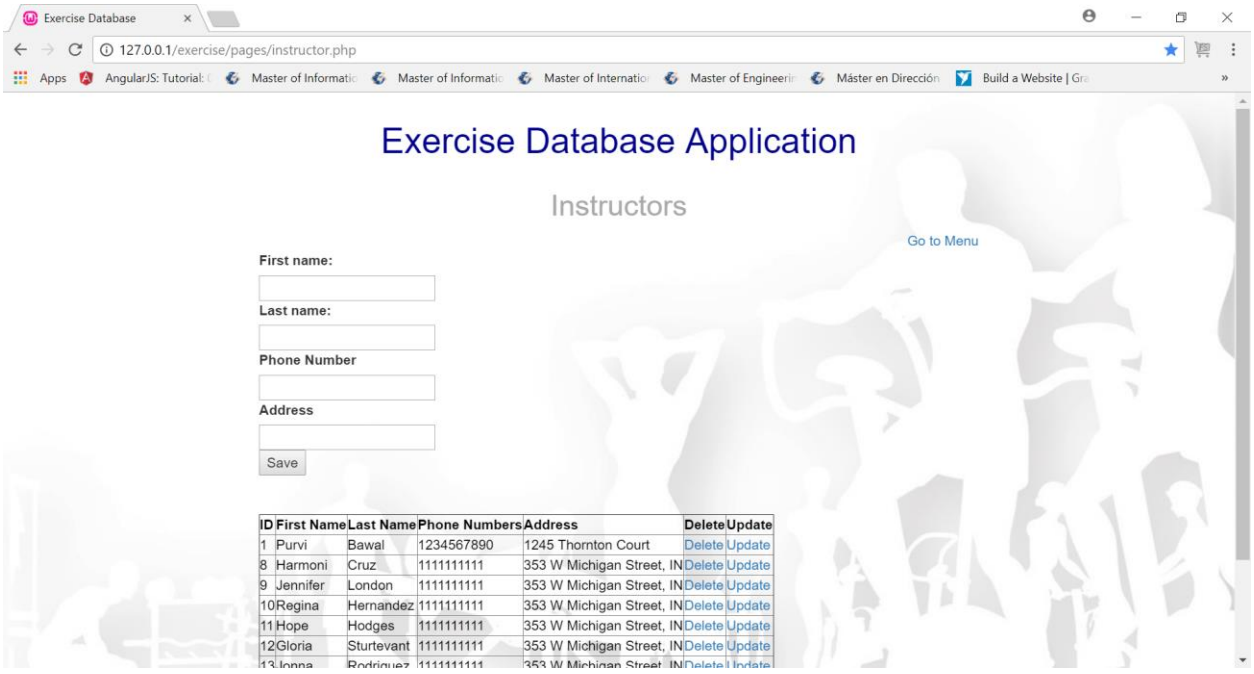


Figure 4 : Insert/Update/Delete Instructors records in database

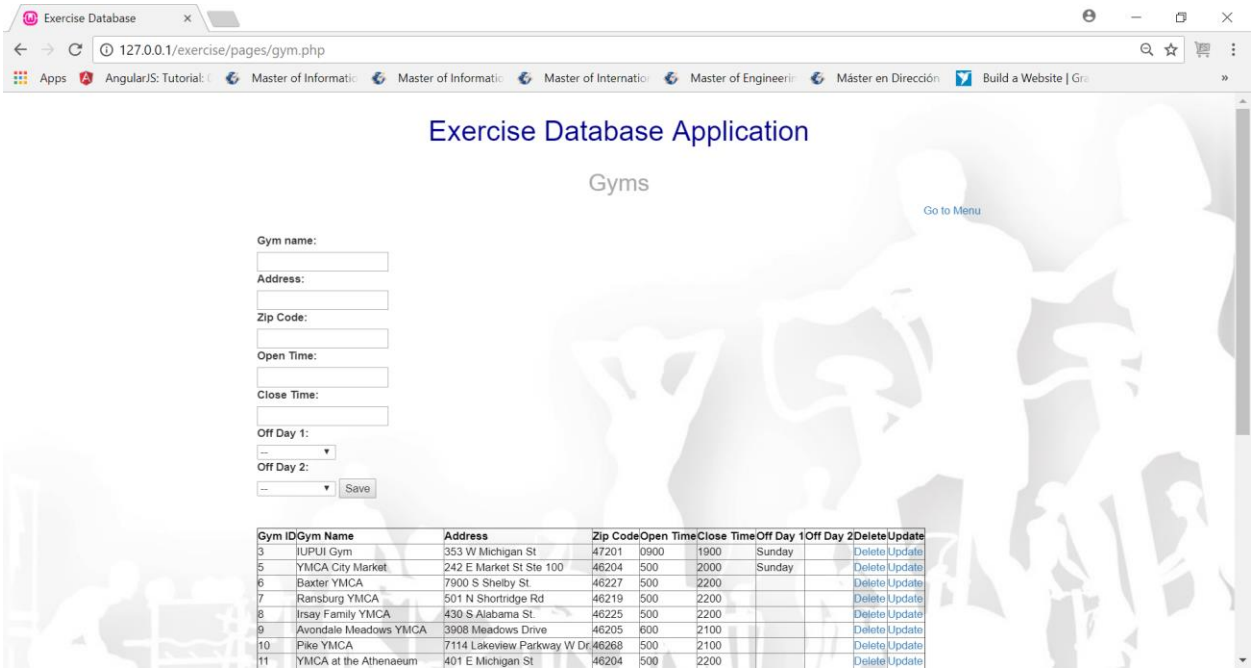


Figure 5 : Insert/Update/Delete Gym records in database

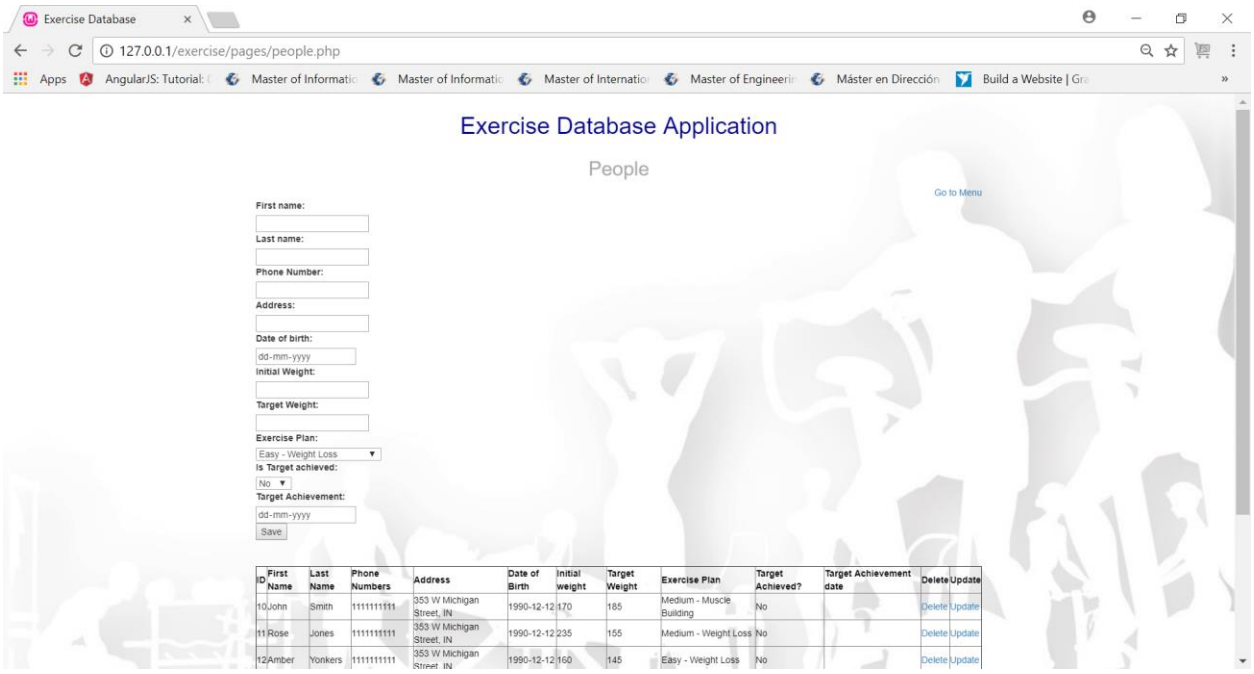


Figure 6 : Insert/Update/Delete records for individual person in database

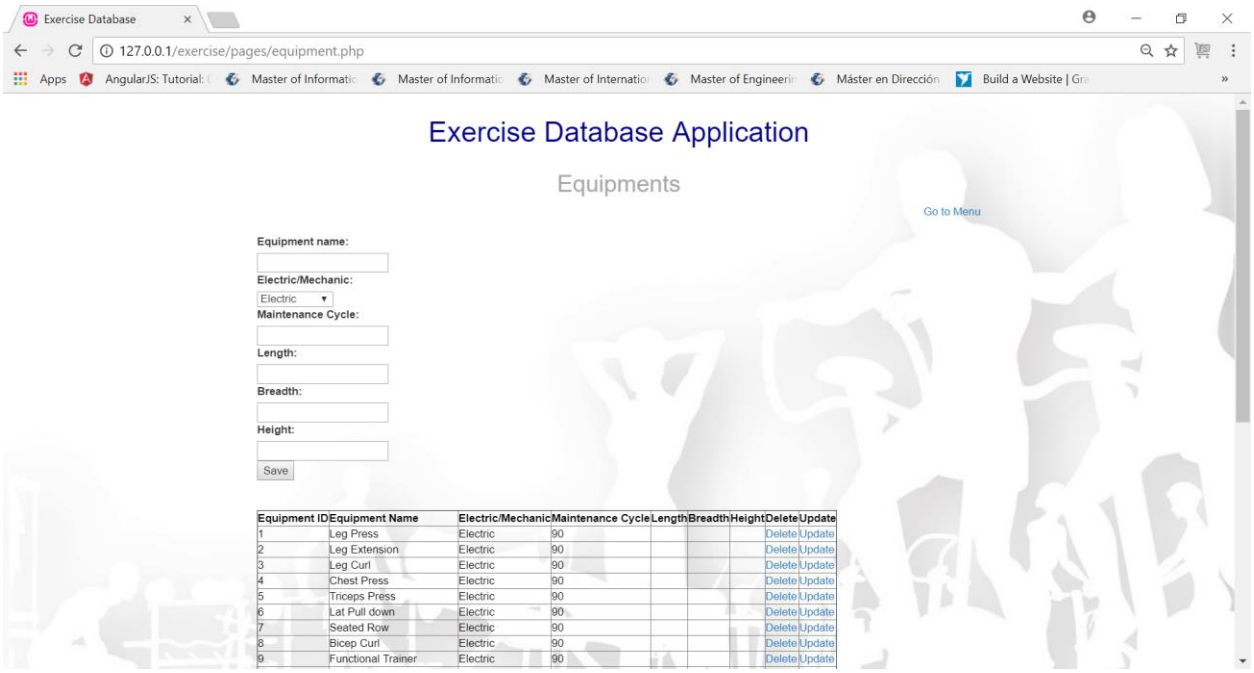


Figure 7 : Insert/Update/Delete Equipment records in database

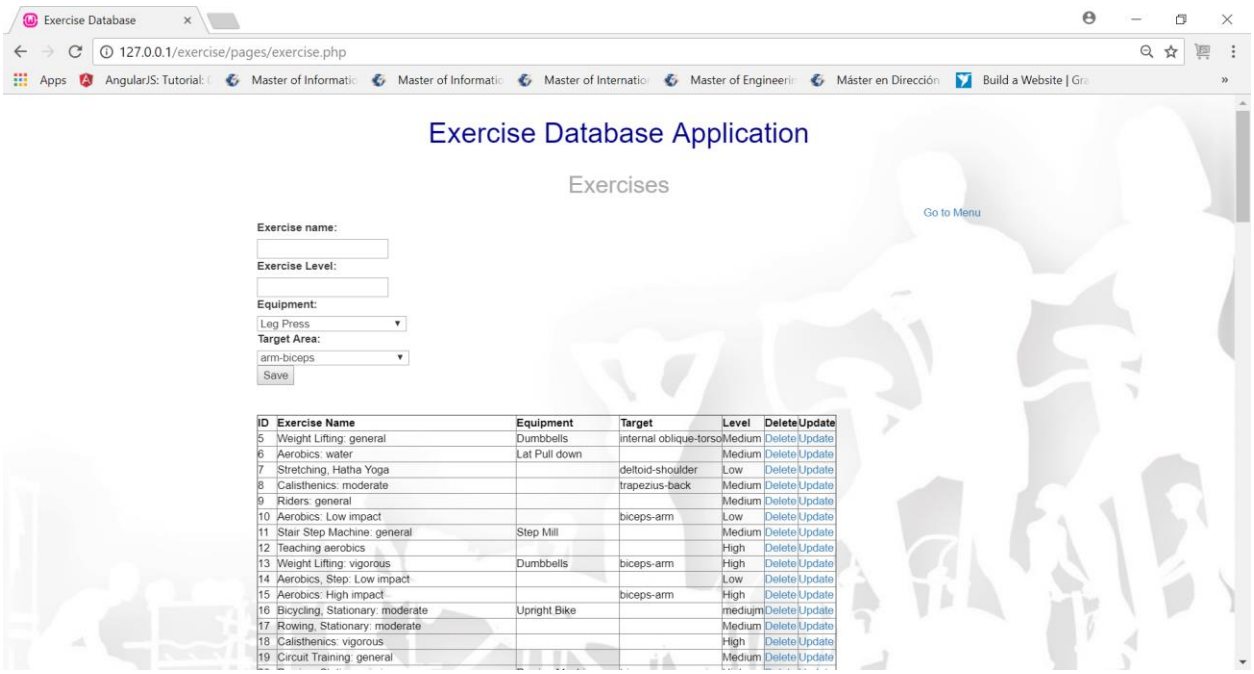


Figure 8 : Insert/Update/Delete Exercises in database

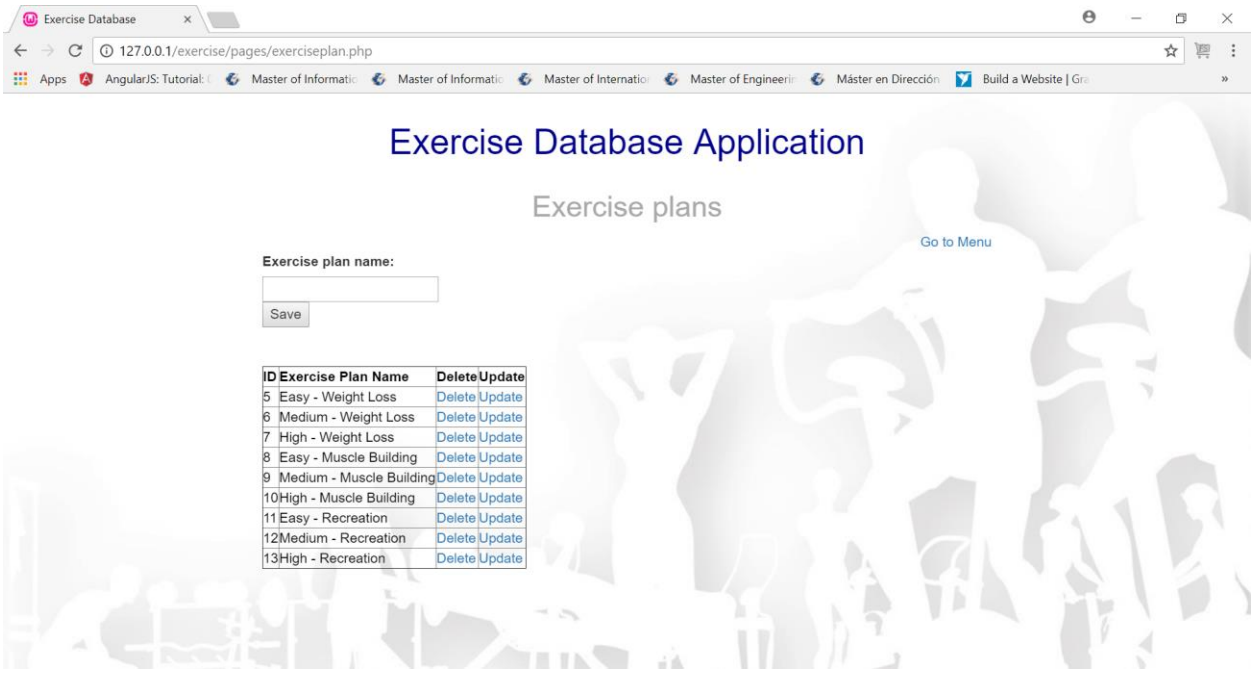


Figure 9 : Insert/Update/Delete Exercise plans for a gym in database

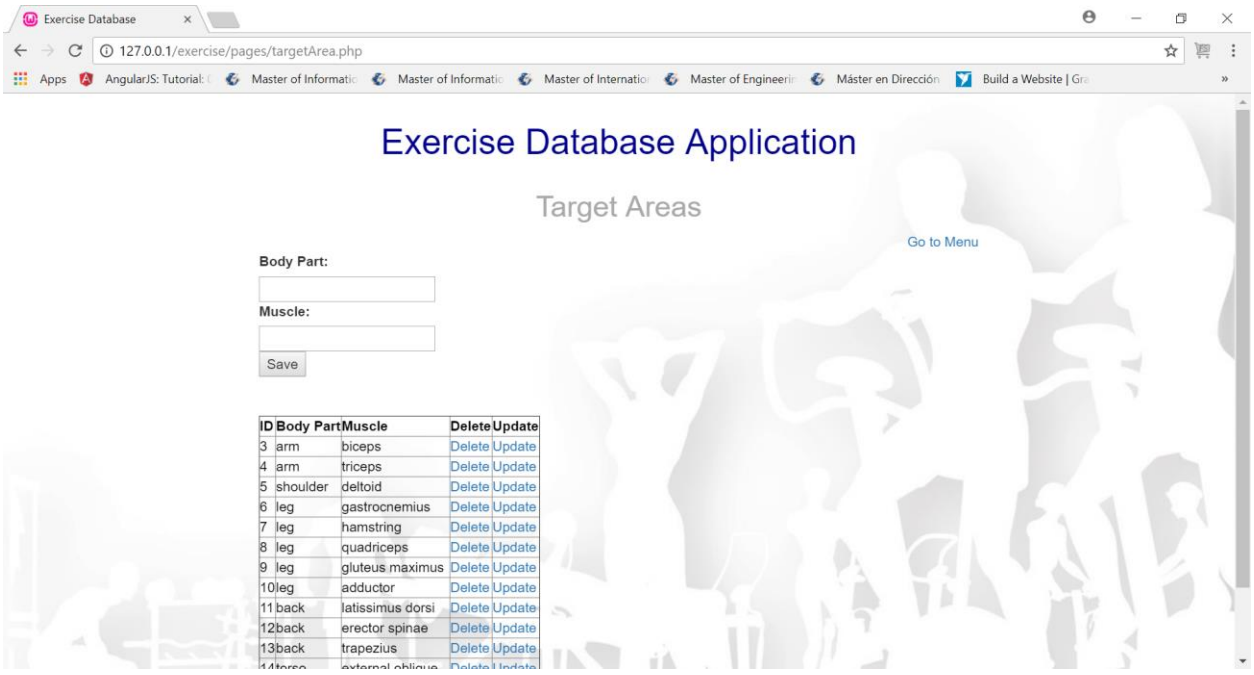


Figure 10 : Insert/Update/Delete Target areas for exercise in database

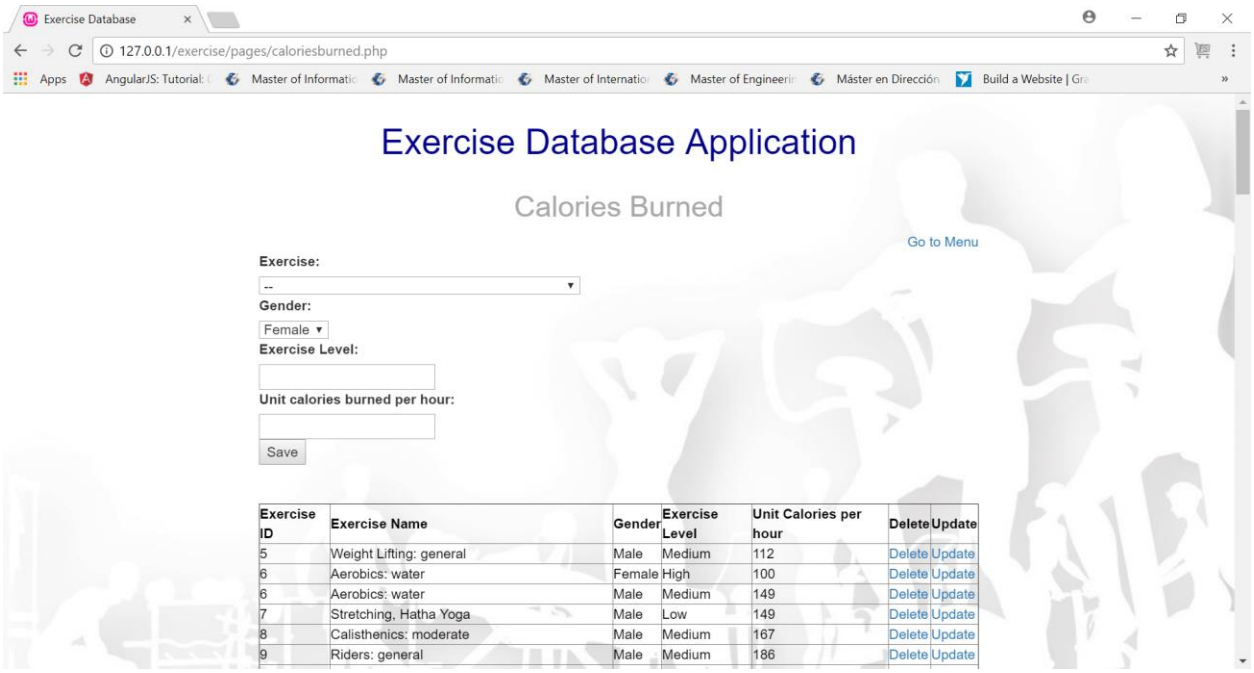


Figure 11 : Insert/Update/Delete Exercise with calories burnt in database

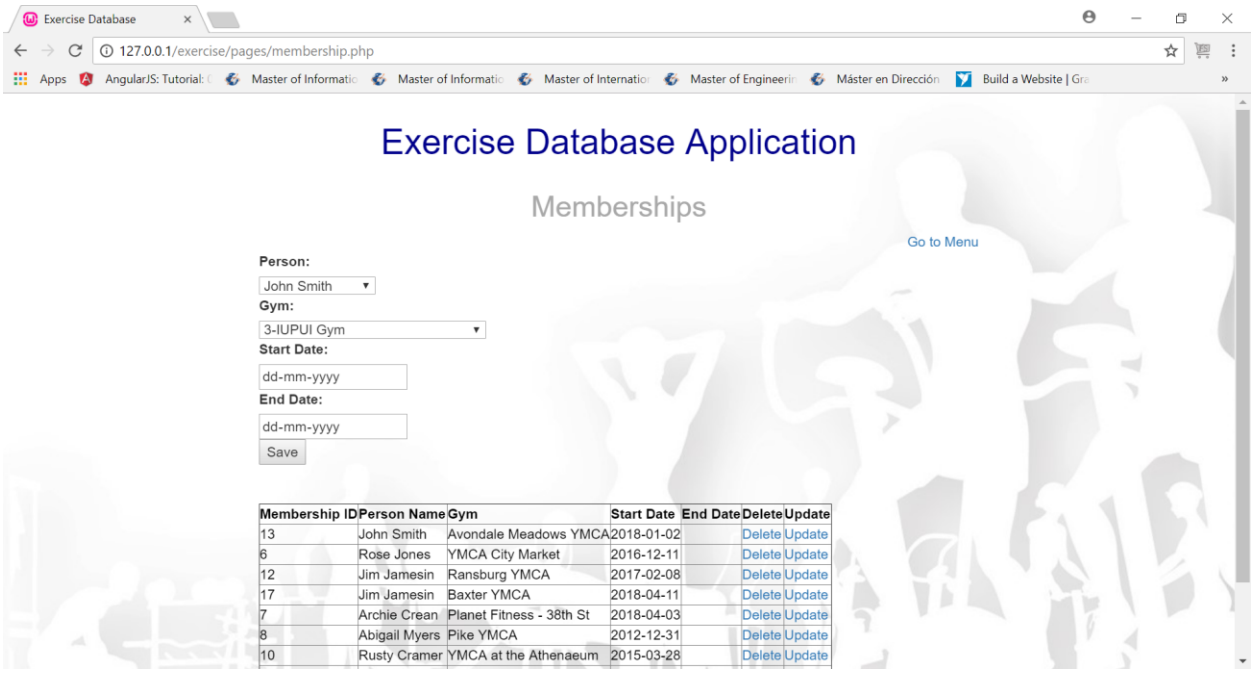


Figure 12 : Insert/Update/Delete membership of people in database

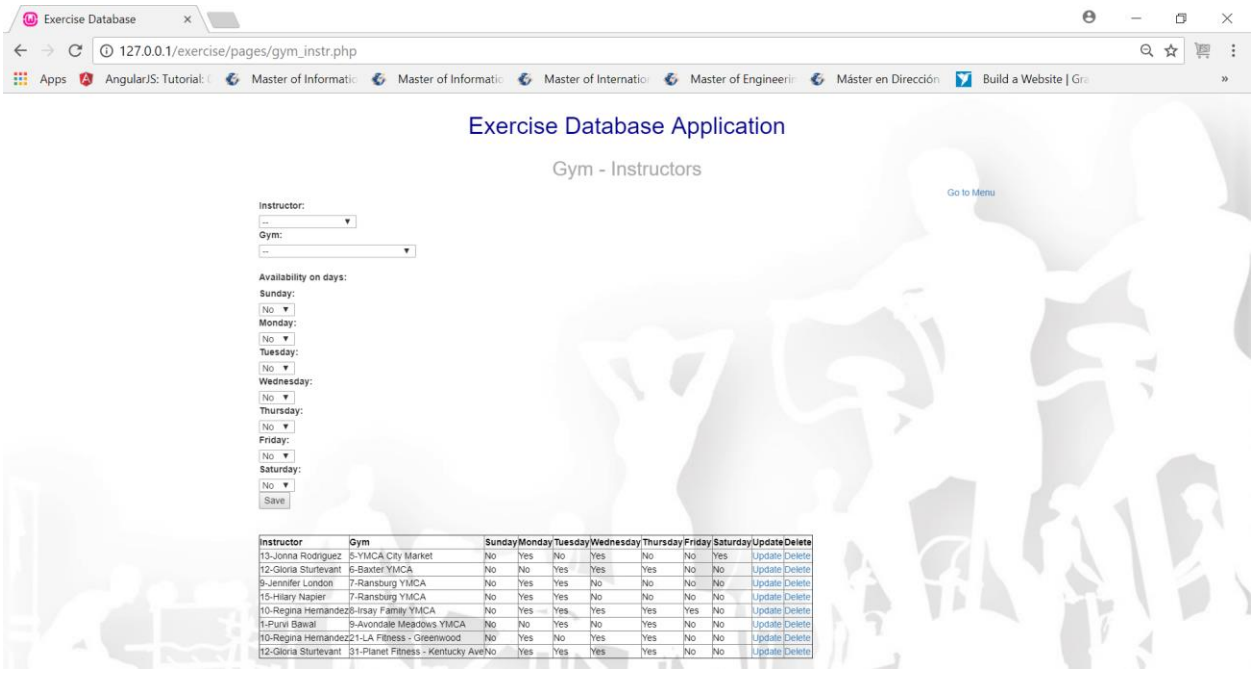


Figure 13 : Insert/Update/Delete Instructors for each gym in database

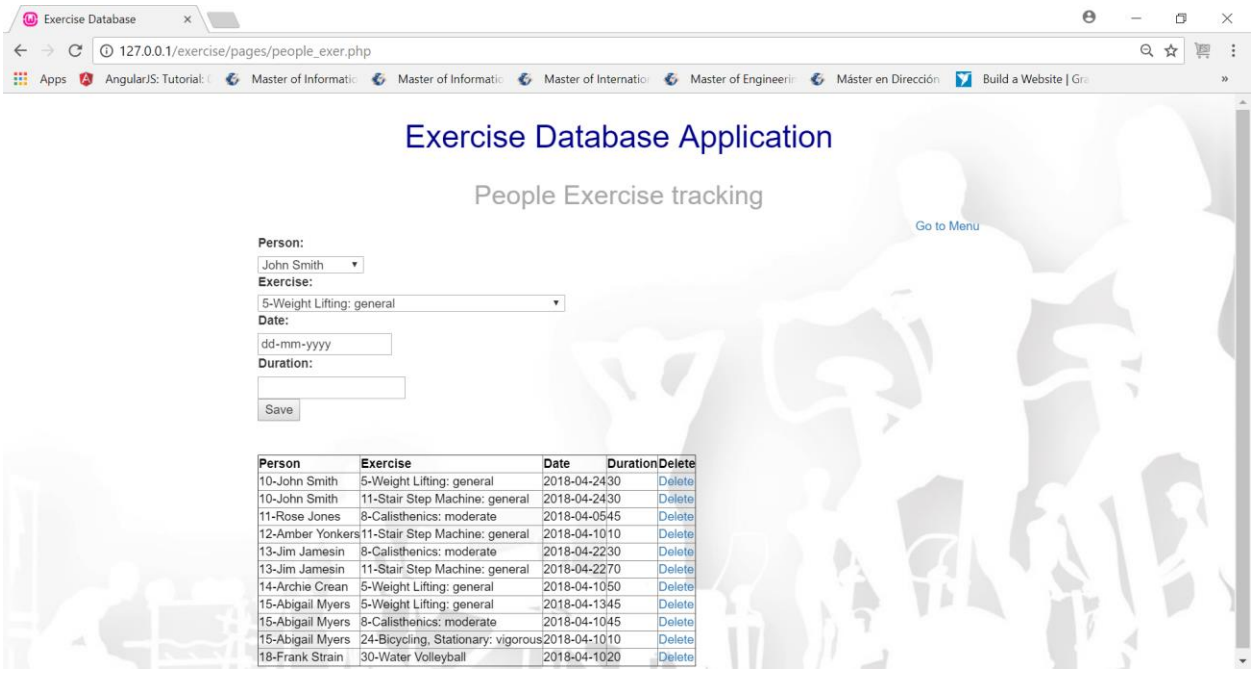


Figure 14 : Insert/Update/Delete track of exercises performed in database

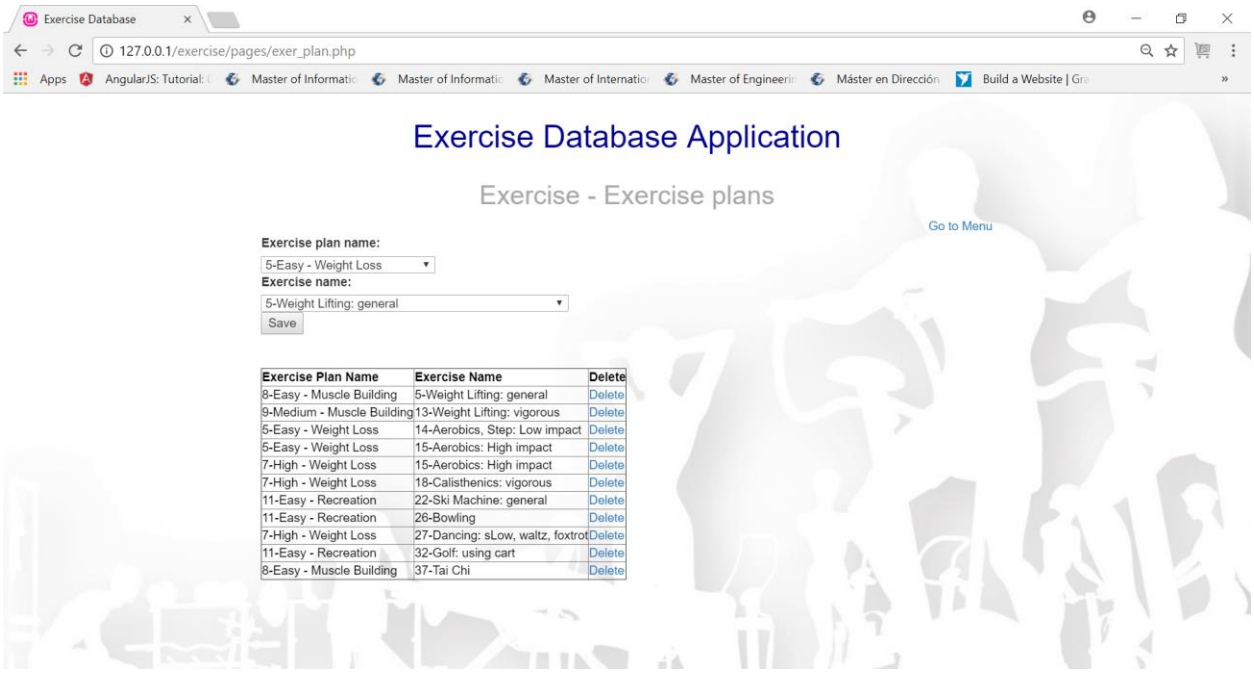


Figure 15 : Insert/Update/Delete mapping details of exercise and exercise plans database

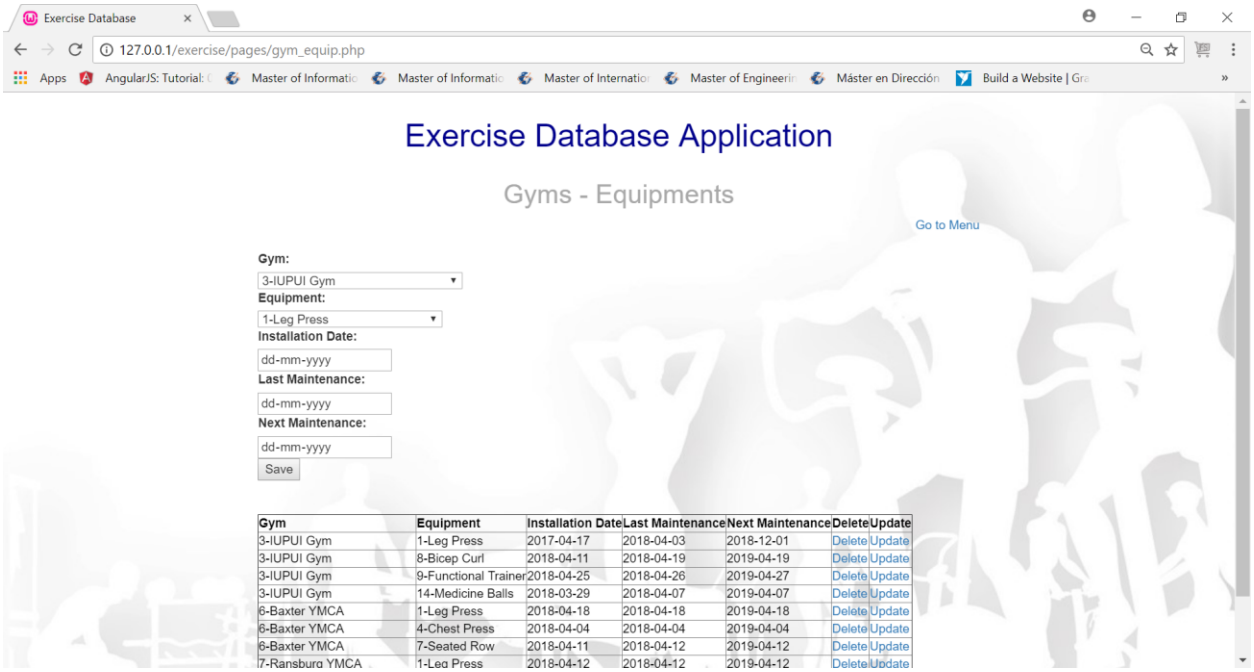


Figure 16: Insert/Update/Delete equipment for each gym in database

To view the inserted data in the above Admin panel, we have created 3 different web pages under the search and report heading. These web pages are as follow;

1. Calories Burned
2. User Information
3. Gym Information

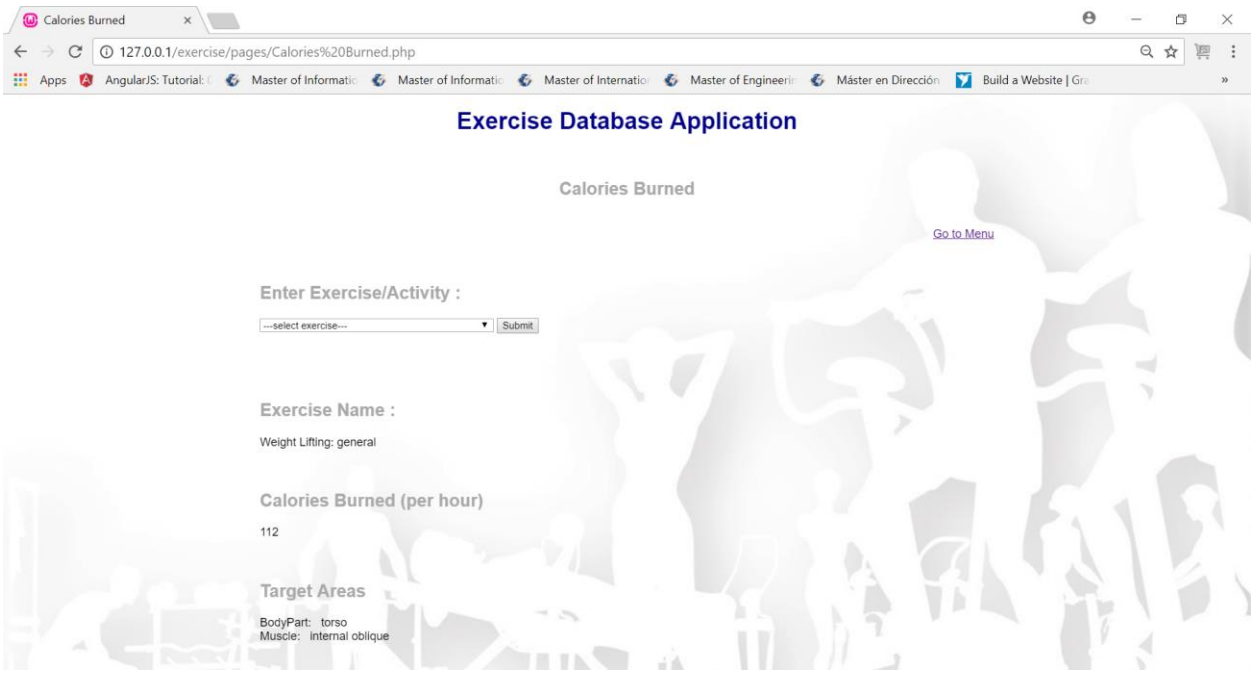


Figure 17: Check calories burnt with exercise

In the above page, the users can check the calories burnt with each exercise or activity recorded in the database. The exercises will also provide the target areas and the muscles of the body that are mostly affected by the exercises or activity.

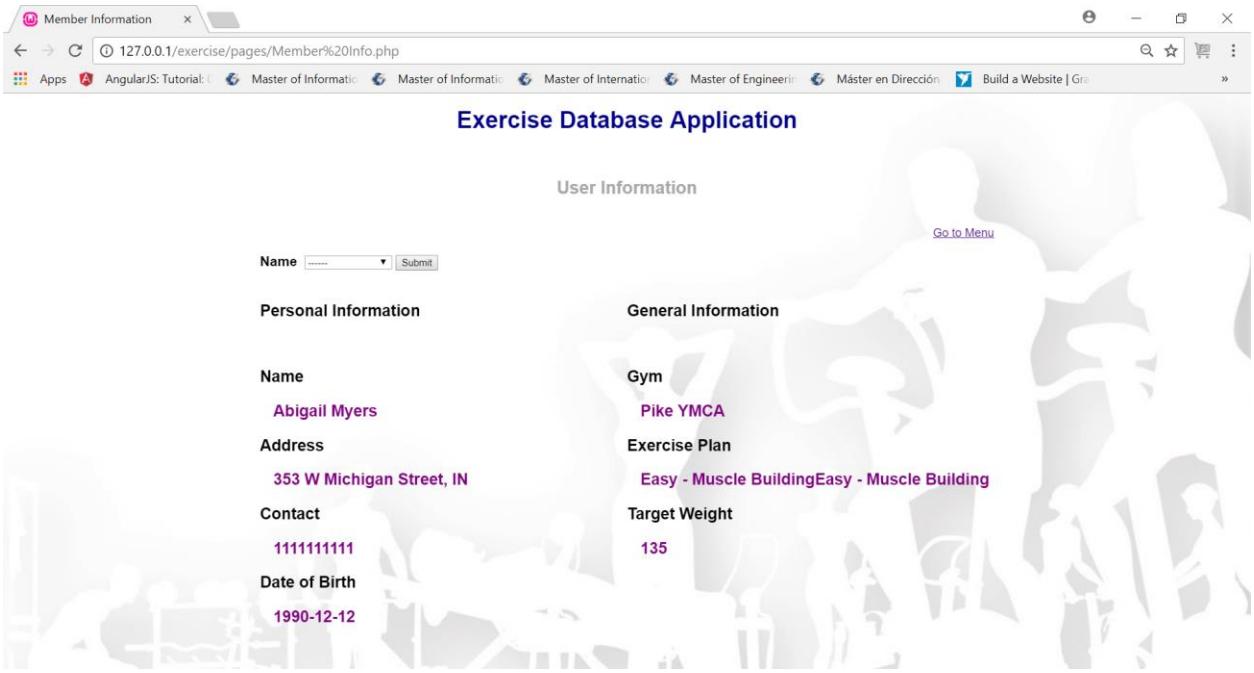


Figure 18: View all data for individual user in database

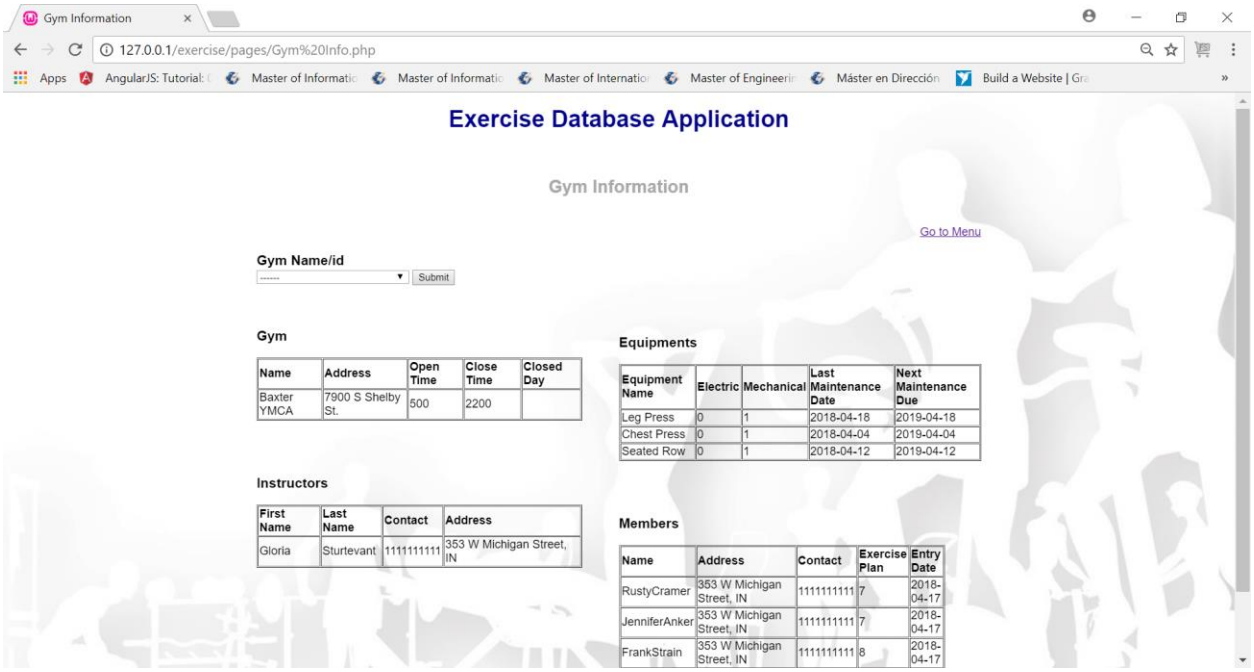


Figure 19a: View all gym information (Instructors, equipments, and members)

The above webpage will contain the information about all the gyms, their instructors, their equipments and their members. We are assuming to run this webpage in admin mode, so for now it will display all this information related to each gym that we select.

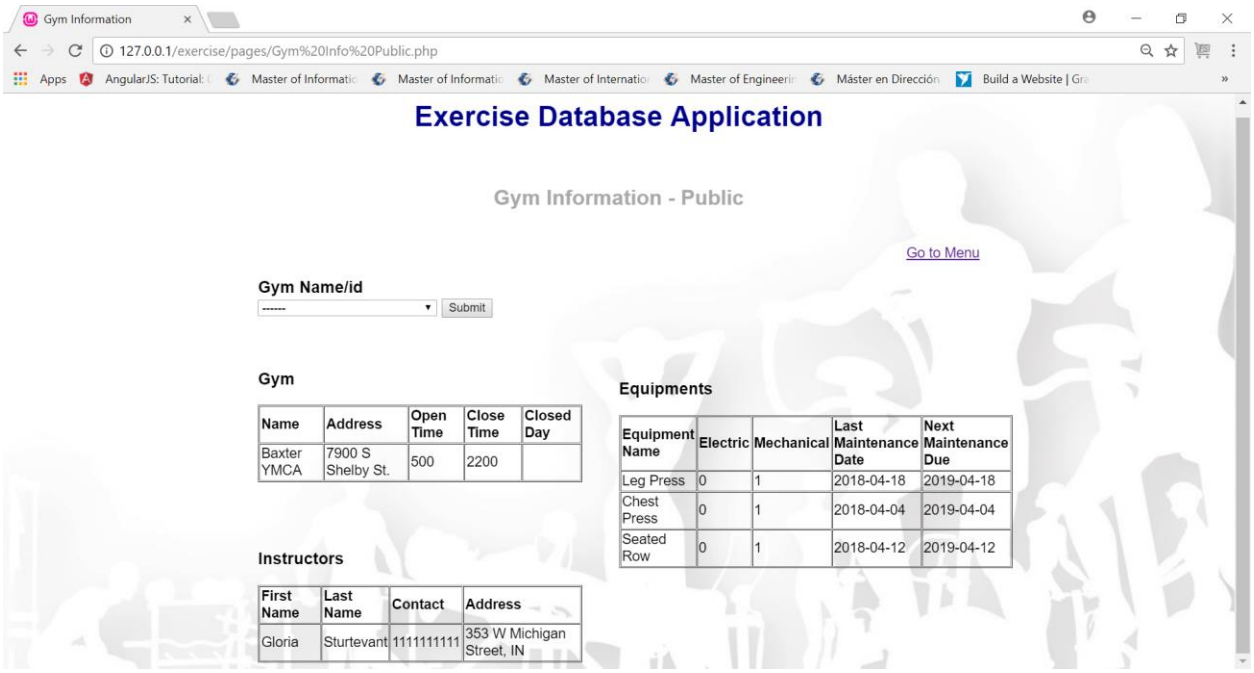


Figure 19b: View all gym information (Instructors, equipments, and members)

To view the report of exercise performed by individuals and calories burned each day can be viewed in the below report screen. There is an option to filter data by person name as well as print this page.

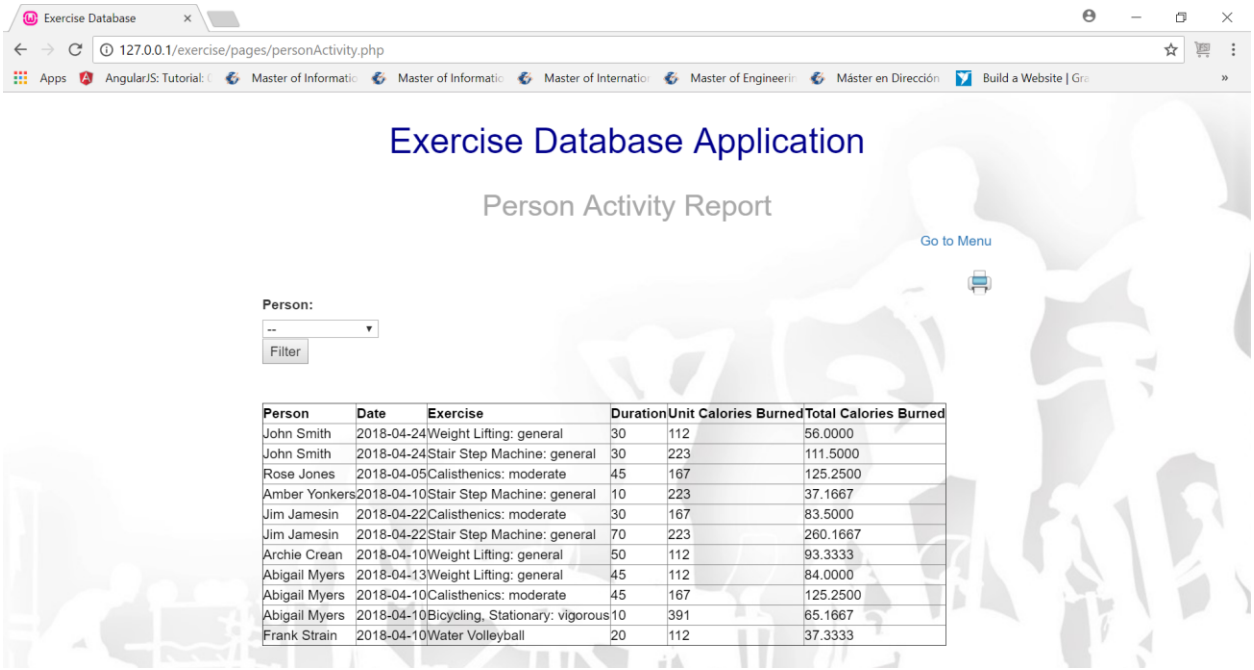


Figure 20: View/Print/Filter exercise report of all users along with calories burned

DISCUSSIONS

Below are a few suggested future enhancements :

1. This application can be enhanced to add individual login page for each user to view his or her activities and reports.
2. GPS can be plugged into the application to help navigate to a gym.
3. Motivational notifications of fellow members to be displayed to other members. This can help encourage people to achieve their targets.
4. BMI calculator can be added as one of the screens.

CONCLUSION

This web searchable database for exercise developed as a part of this project can be used at Gym Facilities to track the progress of each member. This will help maintain all information about the gym, members, instructors, exercise plans, etc electronically. This can also help pull real time reports for individuals with a history of their exercise routines.

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