

Chapter 1

INTRODUCTION

The Internet of things (IoT) is the network of physical devices, vehicles, home appliances, and other items embedded with electronics, software, sensors, actuators, and network connectivity which enable these objects to connect and exchange data. Each thing is uniquely identifiable through its embedded computing system but is able to inter-operate within the existing Internet infrastructure. With steady progress in the field of IOT, new applications which are meant to improve the quality of life of an individual are emerging. The proposed framework is based on previous studies done in the field of strength training and computer science. Smart objects involve sensors/devices which communicate with users and services and perform various computations. These communications and computations with a high level of accuracy and intricacy increase the cost of the system manifold. So, one of our main objectives is to implement the system as frugally and economically as possible.

IOT-based gym management system use proximity sensor. A proximity sensor is a sensor able to detect the presence of nearby objects without any physical contact. A proximity sensor often emits an electromagnetic field or a beam of electromagnetic radiation (infrared, for instance), and looks for changes in the field or return signal. The object being sensed is often referred to as the proximity sensor's target. Different proximity sensor targets demand different sensors. IOT based gym management system allows user to count sets and repetitions automatically by using sensors. This system stores the basic information about the users, there diets and many more. This system also gives the exercise prescription to user by logging on site. The system not only can reduce the waste of human resources and enhance the efficiency of management levels, but also to enhance the welfare of members of gym.

IOT based gym management system allows manager to trace the fitness status of user, there exercises as well as diets. Manager can also have the all the records of fees payment, if

someone fails to pay fees on time this system calculate total fee with penalty itself. Users can calculate there BMI(body mass index), fat, calories etc. by providing some details. User can also watch online videos and home exercises through gym website.

In IOT based Gym Management System some sensors are attach to the machine that calculates the set and repetitions and store data in users database. User can see that data and can managed the further exercise with this. In this system RFID is used for user authentication that store the date and time when user enters into the gym. RFID also used on each machine whenever user workout on machine he/she have to keep RFID card on RFID machine so that the information about sets and repetitions are recorded for that particular RFID card id and stored in database.

1.1OBJECTIVES

- To store basic information of user.
- To store fees and penalty information.
- To store sets and repetitions of users exercise.
- To store fees and penalty information.
- Keep track of maintenance of machineries.
- To calculate fat, calories, BMI etc.
- Exercise prescription.

1.2 Problem Statement

At the movement, most of the people does not know which workout should they follow, we are developing the system that gives the perfect exercises by giving body weight and height. It will also store the repetitions & number of sets into the database using IOT based sensors.

Now a days physical cards are used for storing data of user. The data will be lost if card will be misplaced so instead of using physical card we are doing online system which store all the user data on databases including payment information.

IOT-based Gym Management System uses one sensor which is Proximity Sensors. Proximity sensor are used for detecting object and counting number of repetitions and number of sets. System will also store the physical details such as body fat, BMI, calories etc. This information is stored into the system for further advance workout with diet.

1.3 Organization Of Report

The organization of this paper is structured as follow: Chapter 2 covers all literature survey. Chapter 3 reveals various system requirements. Chapter 4 contains details about the project design. Chapter 5 contains references.

Chapter 2

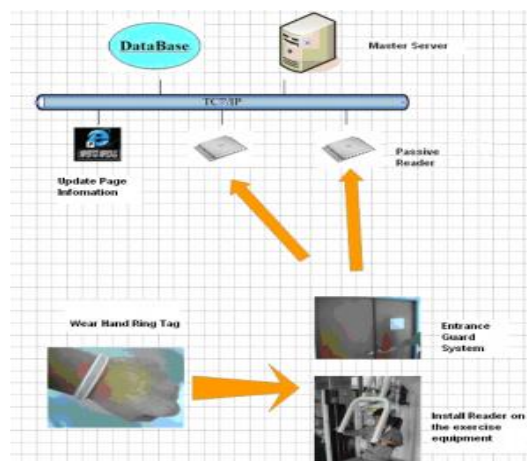
Literature Survey

A literature review is a body of text that aims to review the critical points of current knowledge including substantive findings as well as theoretical and methodological contributions to a particular topic. Literature reviews are secondary sources, and as such, do not report any new or original experimental work. Also, a literature review can be interpreted as a review of an abstract accomplishment.

Most often associated with academic-oriented literature, such as a thesis, a literature review usually precedes a research proposal and results section. Its main goals are to situate the current study within the body of literature and to provide context for the particular reader.

Existing System:-

In RFID-enabled Gym management System, RFID is used for authenticating user and for counting sets and repetitions. User have RFID tagged band on wrist, The RFID tag on the member's wrist automatically collect and record the related fitness data. The RFID system mainly contains three major parts tags, antenna, readers and the computer application system. of membership. User is controlled by RFID not only can manage people according to the record but also can control the machine if reach the maintenance record, and according to need to exercise part of user for planning exercise prescription to find the best fitness effect.



In Smart Gym, the framework is basically an implementation of smart gym based on IOT which provides an efficient utilization of resource present in the gym. The proposed framework is based on previous studies done in the field of strength training and computer science. For instance, work has been done to enhance the tracking of the user and keeping the trainer up to date about the accuracy of movements performed by the user, using motion sensors . A similar proposal is given in with the main difference that the conception takes into account gathered data from sensor-equipped machines to propose a fuzzy logic based evaluation of strength training exercises.

The Stay Fit System is developed to automatically count and detect the number of repetition performed by user. Eight different gym activities that encompass the major muscles of the body are selected in this work. These are further sub divided into Type-I and Type-II categories. Type-I activities include Pushups, Sit-ups, Free- Squats and Skipping which generally involves user's own body weight. Type-II activities include Bicep curls, Lat Pulldown, Chest fly and Bench press which are performed using additional weights. This is used only for Power Training workouts.

A data collection application on Samsung Galaxy Gear S2, operating at 25 Hz, is used to collect the accelerometer and gyroscope sensor data for each of the eight activities along the three axes. Low sampling rate of 25 Hz is chosen to reduce the computational complexity

Proposed System:-

We are developing system which is based on IOT(Internet Of Things) i.e. new technology. The RFID in our system is attach to machine for getting user details. When user go for workout, he/she keeps RFID card on RFID machine, system authenticate user and saves the workout details in database for that particular RFID card user. There are some disadvantages of RFID based system.

Disadvantages of RFID:-

- RFID can only work if there's enough RF signal strength.
- May be difficult to troubleshoot if you have problems with the RF link.
- Affected by metal.

The sensor is used in system is proximity sensor instead of motion and infrared sensors and cost required to fit sensors in the gym is less than cost of one smart band. In the application we use sensors to count the repetitions of workout done by the user and accordingly. After a user performs exercise on a particular machine all the information regarding the sets and repetitions of the exercise is stored in the database. This procedure resembles a typical bookkeeping procedure. Whenever a new schedule is to be formulated it takes cognizance of the past records of the user. This system store information of the user/members. User/member can follow the diet as per given on website. System also provide videos for home based workout so that user/member can follow workout routine at home. User/member can pay there fees online using website or they can pay fees at gym also. If member/user did not pay fees RFID decline the access into the system. User/member can also get the personal trainer. Manager can track all the user details that is basic information, payment information etc. If user pays fee late then penalty will be applied.

As the collection of data using Samsung Galaxy Gear S2 is too costly. Price of a single Gear is more than 20,000 Rs. so it is not possible that every one can buy it. So instead of Galaxy Gear S2 and motion sensor we are using proximity sensors to detect and count the workout's of user. As we are developing system for whole gym workouts so it not possible to provide Samsung Galaxy Gear S2 to each user so we provides sensors to each machine which is less costly as compared to Samsung Galaxy Gear S2.

User can also calculate their BMI, body fat, calories and BMR by entering exact parameters. The formulas used for calculating as follows:

1. Body Fat Calculator:-

Using this system members can calculate there body fat in percentage.

Body Fat Formula For Men	
Factor 1	$(\text{Total body weight} \times 1.082) + 94.42$
Factor 2	Waist measurement $\times 4.15$
Lean Body Mass	Factor 1 - Factor 2
Body Fat Weight	Total bodyweight - Lean Body Mass
Body Fat Percentage	$(\text{Body Fat Weight} \times 100) / \text{total bodyweight}$

Body Fat Formula For Women	
Factor 1	$(\text{Total body weight} \times 0.732) + 8.987$
Factor 2	Wrist measurement (at fullest point) $/ 3.140$
Factor 3	Waist measurement (at naval) $\times 0.157$
Factor 4	Hip measurement (at fullest point) $\times 0.249$
Factor 5	Forearm measurement (at fullest point) $\times 0.434$
Lean Body Mass	Factor 1 + Factor 2 - Factor 3 - Factor 4 + Factor 5
Body Fat Weight	Total bodyweight - Lean Body Mass
Body Fat Percentage	$(\text{Body Fat Weight} \times 100) / \text{total bodyweight}$

Classification	Women (% Fat)	Men (% Fat)
Essential Fat	10-12%	2-4%
Athletes	14-20%	6-13%
Fitness	21-24%	14-17%
Acceptable	25-31%	18-25%
Obese	32% +	25% +

1.

2. Body Mass Index:

Formula:- $BMI = \frac{\text{weight(kg)}}{(\text{height(m)})^2}$

Understanding your Body Mass Index

If your BMI is below 18.5: Your BMI is considered underweight. Keep in mind that an underweight BMI calculation may pose certain health risks. Please consult your healthcare provider for more information about BMI calculations.

If your BMI is between 18.5-24.9: Your BMI is considered normal. This healthy weight helps reduce your risk of serious health conditions and means you're close to your fitness goals.

If your BMI is above 30: Your BMI is considered overweight. Being overweight may increase your risk of cardiovascular disease. Consider making lifestyle changes through healthy eating and fitness to improve your health. Our Couch to 5K training plan is a great place to start.

3. Calories needs &BMR:-

Formula:-

$W = \text{weight in kilograms (weight (lbs)/2.2) = weight in kg}$

$H = \text{height in centimeters (inches x 2.54) = height in cm}$

$A = \text{age in years}$

Men: $BMR = 66.47 + (13.75 \times W) + (5.0 \times H) - (6.75 \times A)$

Women: $BMR = 665.09 + (9.56 \times W) + (1.84 \times H) - (4.67 \times A)$.

Chapter 3

System Requirements

3.1 Functional Requirements:

- Store Data:
 1. System will store user data, fees details, trainer data.
 2. System will store information about gym equipment's.
 3. System will store workout details of user.
- Exercises Details: The system gives detail information about particular exercises, it also provide home based exercises information to offline user.
- Physical Details Calculator: The system calculates the physical details of the user, user have to entered their height and weight only.

3.2 Hardware And Software Requirements:

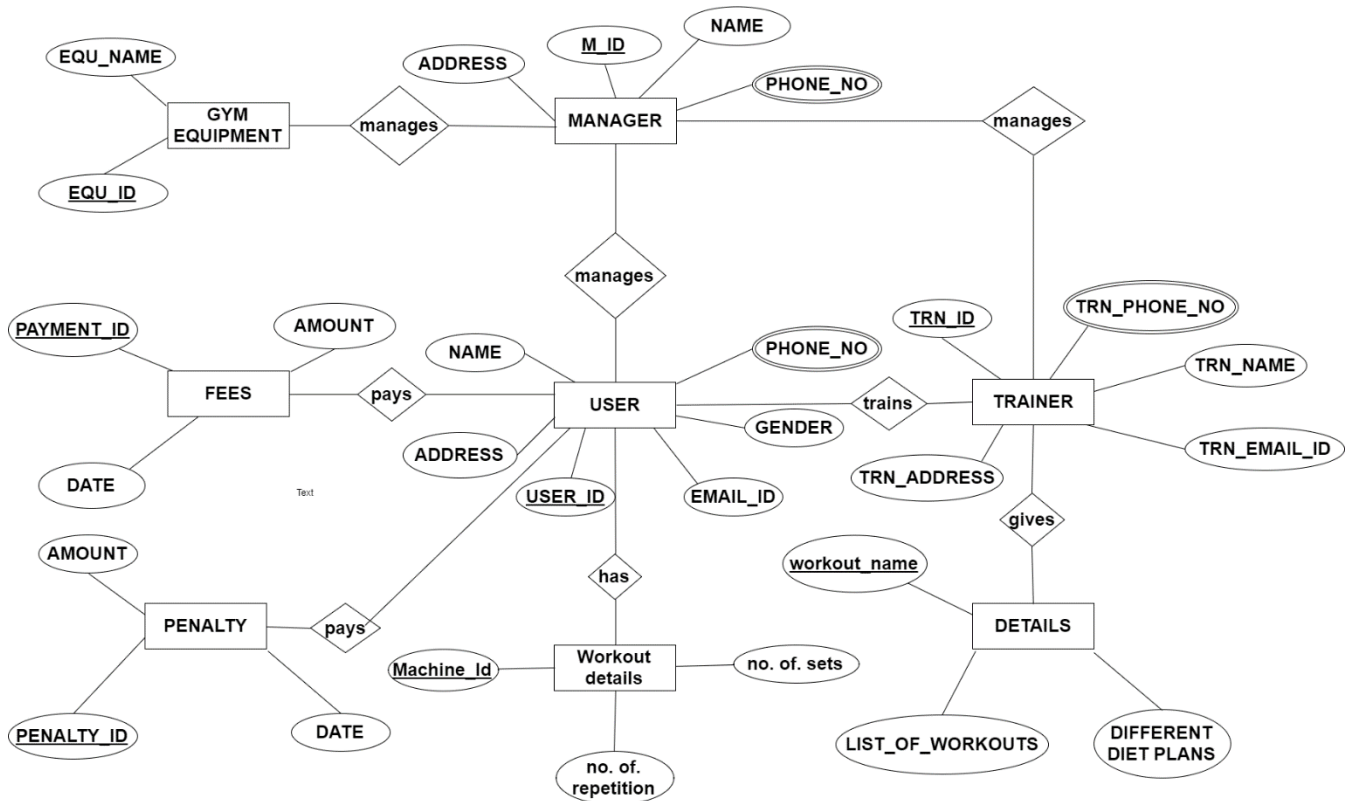
- Hardware-
 1. Raspberry pie
 2. Proximity sensor
 3. Gym equipment
 4. Breadboard And connecting wires
 5. RFID sensor

- Software-
 1. Python
 2. HTML/PHP
 3. MySql

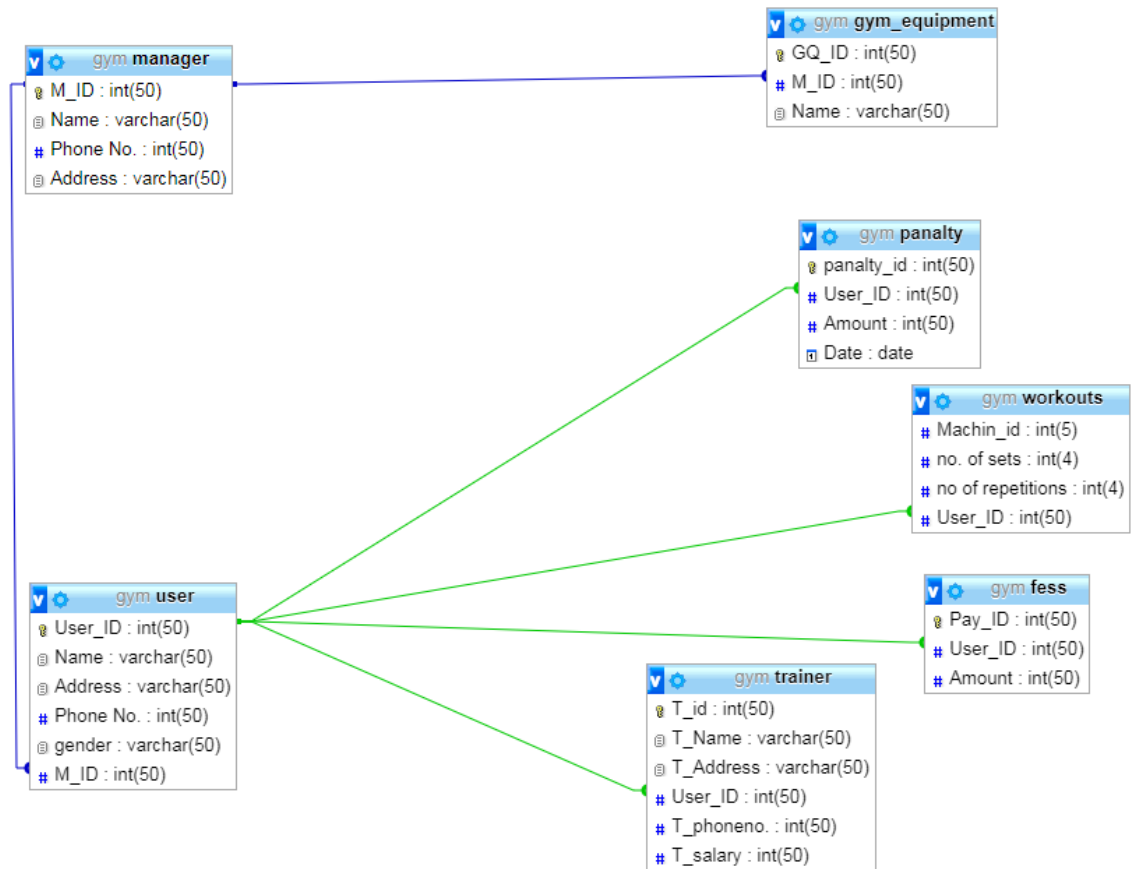
Chapter 4

Design

4.1 ER Diagram

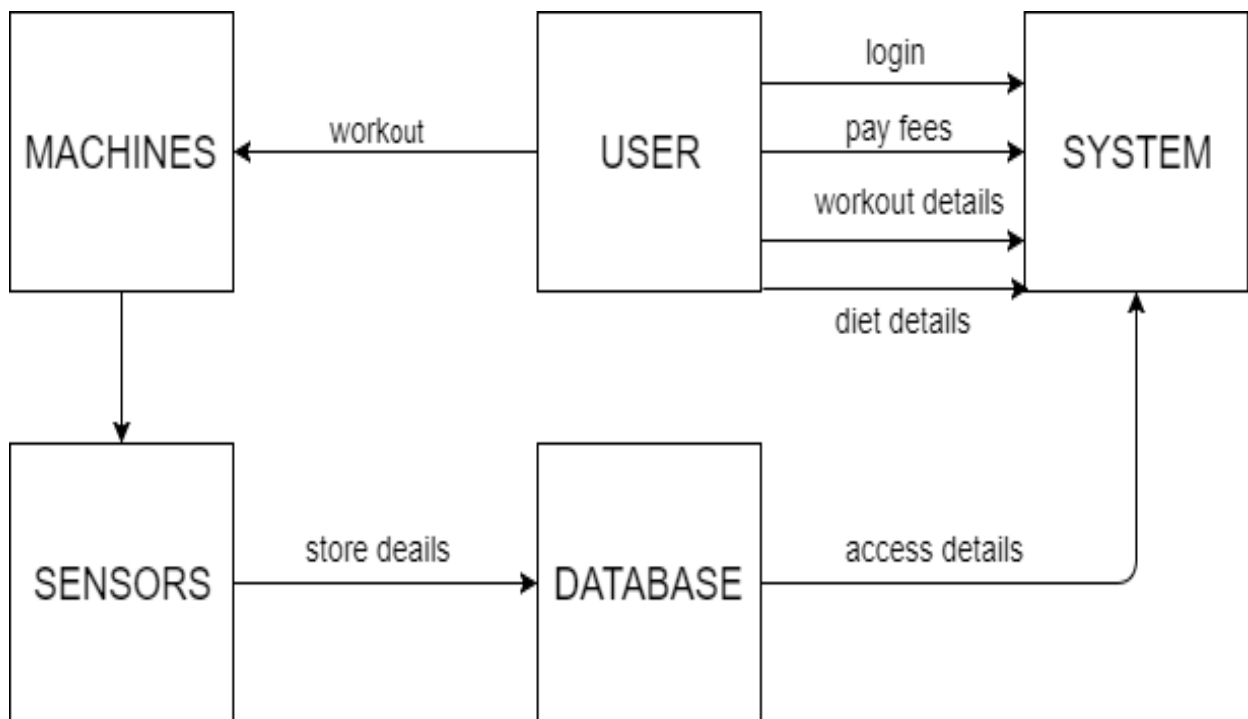


4.2 Database Schema



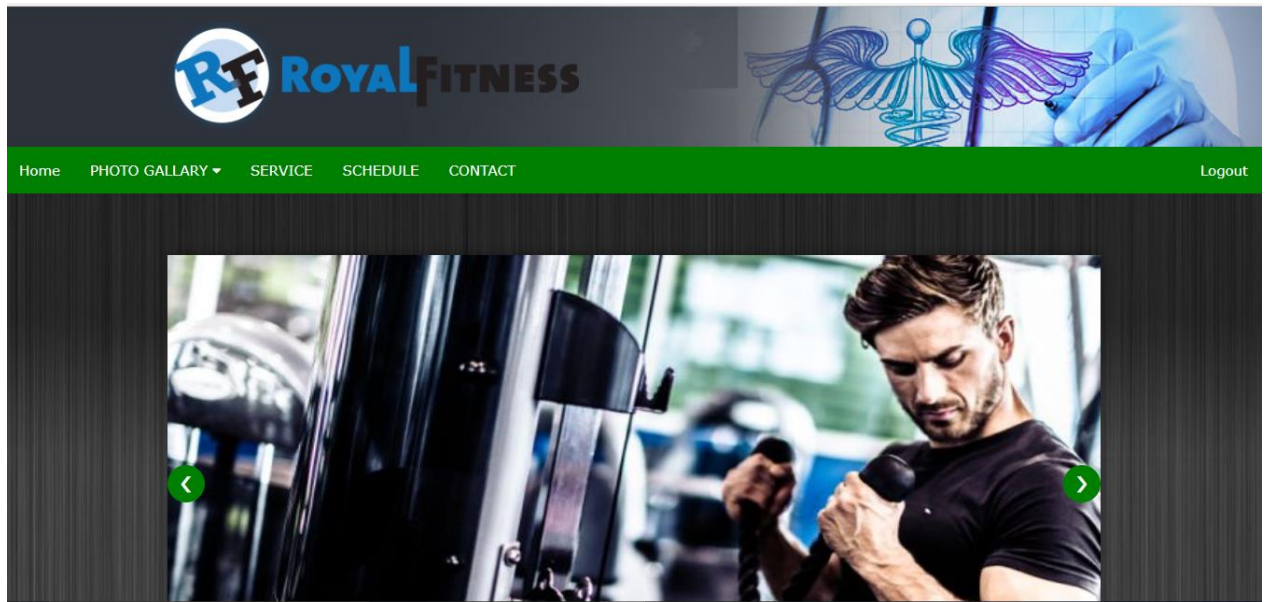
4.3 User Interface Design

4.3.1 System Block Diagram



4.3.2 Input Output Forms

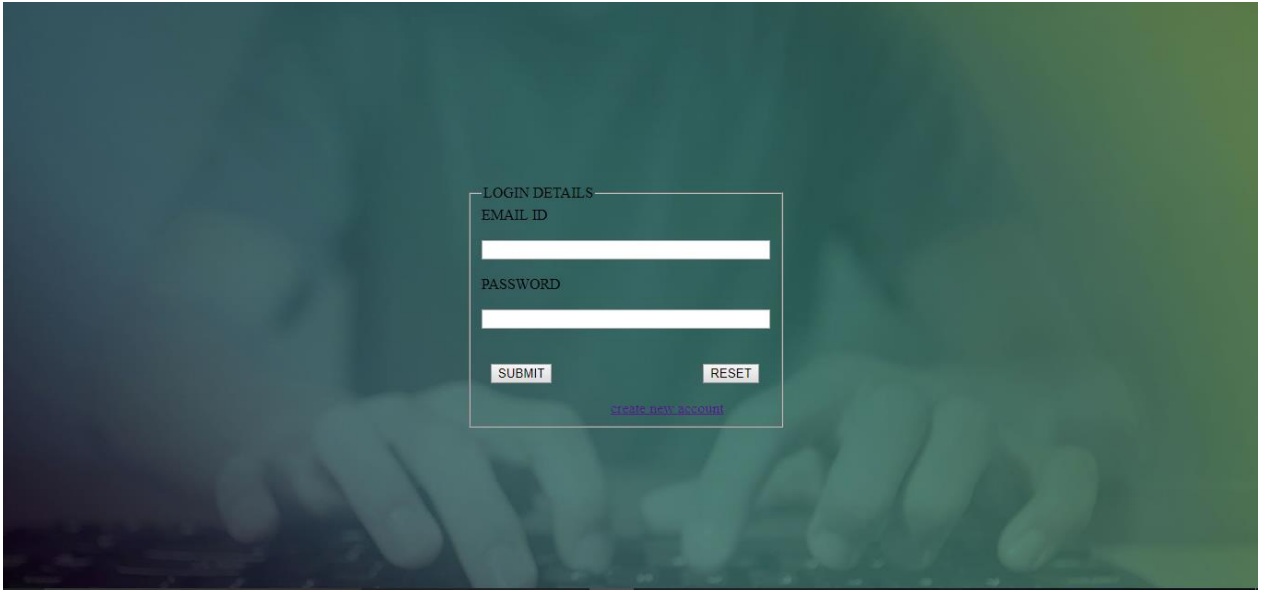
- Main Page



- Registration Page

The image is a screenshot of a web browser displaying a registration form. The browser's address bar shows the file path 'file:///E:/GYM/Project/registration.php'. The page has a dark, textured background with a barbell and weights on the right side. On the left, there is cursive text that reads 'Start Building Your Body, Start Building My Character'. The registration form is titled 'Register' and includes a 'Back to HomePage' link. The form fields are as follows: 'First Name' (text input), 'Last Name' (text input), 'Address' (text input), 'Email Address' (text input), 'Username' (text input), and 'Password' (password input). The Windows taskbar at the bottom shows various application icons and the system clock indicating 11:00 AM on 11/5/2017.

- Login Page

A login page with a dark green background featuring a blurred image of hands typing on a keyboard. In the center, there is a white rectangular form titled "LOGIN DETAILS". Inside the form, there are two input fields: "EMAIL ID" and "PASSWORD". Below the "PASSWORD" field, there are two buttons: "SUBMIT" and "RESET". At the bottom of the form, there is a link that says "create new account" in a purple color.

LOGIN DETAILS

EMAIL ID

PASSWORD

SUBMIT RESET

[create new account](#)

Chapter 5

References

1. Bajpai; V. Jilla; V. N. Tiwari; S. M. Venkatesan; R. Narayanan, "Quantifiable fitness tracking using wearable devices". Engineering in Medicine and Biology Society (EMBC), 2015 37th Annual International Conference of the IEEE, (2015), pp.1633-1637.
2. Fahey, Thomas D., and C. A. Chico. "Adaptation to exercise: progressive resistance exercise." Sports.org, April (1998).
3. Conroy, B. P., and R. W. Earl. Bone, muscle, and connective tissue adaptations to physical activity. Essentials of Strength Training and Conditioning. TR Baechle, Champaign, IL: Human Kinetics, 1994.
4. Hather, B. M., P. A. Tesch, et al. "Influence of eccentric actions on skeletal muscle adaptations to resistance training." Acta Physiologica Scandinavica 143, no. 2 (1991): 177-185.
5. Conroy, B. P., W. J. Kraemer, C. M. Maresh, and G. P. Dalsky. "Adaptive responses of bone to physical activity." Med Exerc Nutr Health 1 (1992): 64-74.
6. Mortazavi, Bobak Jack, et al. "Determining the single best axis for exercise repetition recognition and counting on smartwatches." Wearable and Implantable Body Sensor Networks (BSN), 2014 11th International Conference on. IEEE, 2014.
7. Ainsworth, Barbara E., et al. "2011 Compendium of Physical Activities: a second update of codes and MET values." Medicine and science in sports and exercise 43.8 (2011): 1575-1581.

8. Stockman, H., "Communication by means of power", Proceedings of the IRE, Vol. 36 No.10, 1948, pp.1196-204.
9. C. Q. Song, Evaluation of Radio Frequency Identification at Distribution Center, Master dissertation, National Chiao Tung University, Hsinchu City, 2004.
10. EPC global TaiwanK<http://www.epcglobal.org.tw>
11. RFID application officeK<http://www.rfid.org.tw/>
12. 7. Yu-Yao Lee and Yi-Di Yu, RFID Identification card of the access control information system South Taiwan's information technology and application conference 2007, pp.226-231.

Chapter 6

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