RFIT - The Smart Way To Do Fitness

Florian Hartl
f.hartl@tum.de

Raphael Verbücheln
raphael.verbuecheln@gmail.com

Berzan Yildiz
berzan.yildiz@tum.de

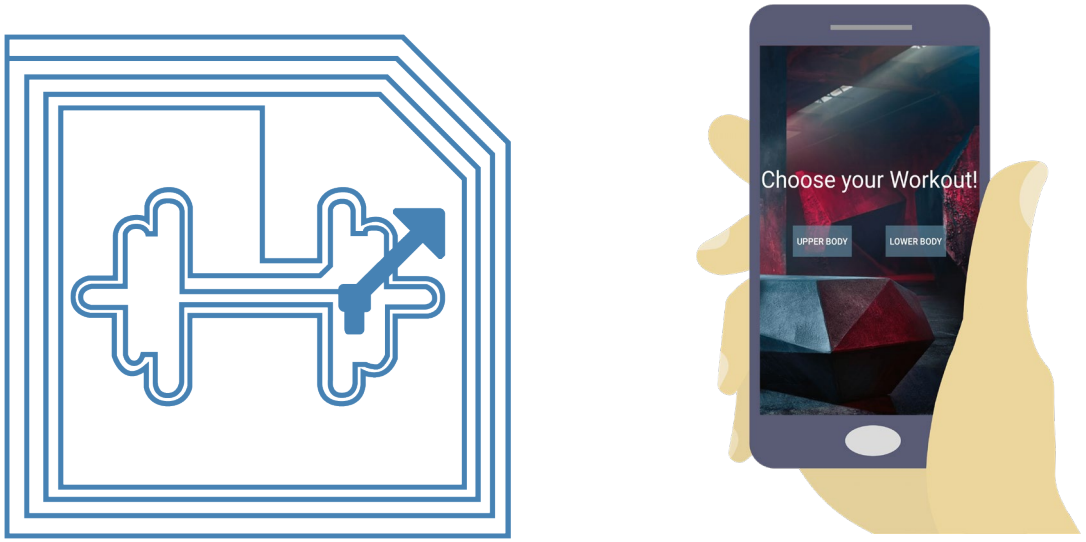

Figure 1: Self-designed Logo of the app RFit (left) and Main Screen of the app, after you open it and already signed in (right)

1. A normal day at the gym

It is Monday. After doing nothing all weekend Hanna feels bad because she did nothing for her fitness and simply ate too much at the dinner with her family on Sunday. It's time to hit the gym. She packs her bag, packs some clothes, takes a bottle of water and off she goes.

Arriving at the gym she has to stop, she needs to show her gym ID to get into the gym. Today time she finds it after a short search in her purse, thankfully she didn't forget it at the counter like last time or had to search the whole bag.

After changing to workout clothes, she stops again, what kind of workout should she do today? Only cardio? Or train some muscles? Or both? After a short amount of time she feels like today she wants to do a bit of both. She looks around in the gym. She sees some people on cross trainers and thinks about her personal trainer, advising her to always warm up before exercising. Hanna does a short warmup and after that, she stops again.

What to exercise now? Start with the back first or rather do some chest? Or back? Not sure which one to choose she walks over to a barbell. She remembers an exercise she has seen when she watched her friend Lou. It was some kind of inverse biceps curls, which looked interesting, but she can't remember it. Since her trainer told her to not do something of which she doesn't know the correct execution she skips it. She decides to start with some triceps, cause her arms really feel wobbly after all the cake she had with her coffee. She takes the 5kg dumbbell because she can't remember how much she did last time. It's too little, she changes to 8kg, which is a bit much but fine and she doesn't want to change again. Changing your workout weight too often always feels like not knowing what to do and Hanna doesn't want to look lazy or dumb in front of the other people in the gym.

She starts: first, second, third, … after 10 she stops, not exactly sure if this is as much as she did last time, but 10 feels like a good number to stop.

While resting she looks at her smartphone. Is Lou also here? Does she go to gym on Monday? She texts her on WhatsApp. After that she checks her newsfeed on Facebook. She finds an awesome story of a couple travelling in India. After 5 minutes she remembers she should exercise again. The break was too long, she feels her muscles are already relaxing and cooled off, she is annoyed that she always forgets time while browsing her newsfeed. For her third repetition she uses her smartphone to set a timer for 1 minute.

Time to do a new exercise! She looks around, she remembers she has got a piece of paper from her personal trainer listing recommended exercise and weights, but she is not sure where she put it and also it was outdated because she has improved on most exercises by increasing weights and repetitions.

It's time to do some cardio on the treadmill! She walks over to cardio area and looks for an empty one. She puts in 6/10 as resistance of the treadmill, because she thinks she can hold that load for 20 minutes. After 15 minutes she is completely out of breath and puts down the resistance to 3/10, a bit disappointed of herself not keeping it to the end, even though she's not sure whether this was the right setting and she whether has done more or less than this in her last workout.

After this she needs a small break. She drinks some water and checks her phone.

As her last exercise today, she wants to train her shoulders, because she hasn't done that for quite some time. She looks in the machine area for something which seems like a machine where you need to push something upwards. She sits down on one machine where you need to push weights directly upwards. After 15 repetitions she stops for a break. She looks at her phone, Lou responded that she will train tomorrow. After estimating the usual minute of rest, she does her last and final set of shoulder exercise. It's over! What a good feeling. On the way to the shower she sees some protein bar at the counter, but Hanna doesn't want to go back to changing room, get her credit card, go back and buy it. So, she skips directly to the showers. After she packs her bag and checks out. Not exactly sure whether this was a good workout in comparison to last week, but she still feels her body needing some rest, which was the reason for her to go in the first place.

Hanna can't help herself but to feel frustrated: She has spent so much effort in managing her workout and constantly worrying about which exercise to do next on which machine while she is in the gym. She has not found an analogous or digital solution yet that relieves her of this anxiety.

2. RFIT - Exercising the smart way!

The next time Hanna goes to the gym she will use RFit, which is provided by her gym to help her with exercising and achieving goals. The App accompanies her at almost every step in the gym! But let's start over to see the improved training step by step. It starts even before she plans to go the gym!

2.1 Notifications and Reminders

RFit sends her a notification on Sunday evening, that she did her last exercise on Wednesday and that it's time to go again on Monday to achieve her set goal of 2000 calories of workout per week.

2.2 Friends list

Before leaving she checks the friends list, which is part of RFit and sees that her friend Lou was at the gym yesterday and will probably be next day, so she considers moving her own training schedule to Liu's, because it is much more fun to go together to the gym. This time however, she goes alone.

2.3 Authentication

At the counter, instead of searching for her collar or wristband of the studio she just opens her app and the entrance bar opens automatically. Not a second wasted on searching or even going back to the flat if you forgot it. Same at the wardrobe, instead of using the additional equipment of the studio, she just pulls up her phone and opens and closes the locker to store her bag inside with RFit.

2.4 Workout management

Before starting the workout and thinking about what machines to use or what exercises to do,

she goes into to the app again. She calls up the workout she prefers to do, which could be the one from last week or another one prepared for her by her trainer or predefined ones provided by RFit or the studio. She can also look at the workout of friends, get recommended workouts from the internet or just create her own workout schedule. This helps one's training progress because one doesn't do similar exercises twice or unhealthy sequences of exercises.

Hanna choses the easiest way: "Last workout". Which also allows her to see how she did last week.

2.5 Exercise and machine selection guided by RFID

As soon as a workout is chosen, all the planned exercises are displayed and the optimal sequence is shown. Ideally you start from top to bottom, so in Hanna's workout it starts with biceps curls first. Hanna doesn't need to search for the machine, a picture and the location of it in the gym is already prepared to show, if she doesn't remember or is new to this gym.

As soon as she arrives there, she will put her phone to scan the RFID tag at the machine, making the app show how much weight she used and repetitions she did last time. If she, by accident, went to a wrong machine, a notification shows up that this isn't the right machine for this workout. Nevertheless, he could choose to add this machine into her workout, or continue on with the correct one. If she can't remember the correct execution, she can see a video of a trainer. She sets the weight to her last setting and begins. After the proposed repetitions she clicks in the app and an automated timer of the proposed break time counts down, making it hard for her to overextend her break, like she did last time. In her second set she increases repetitions and during the break she updates her app about this, showing her directly that she improved (or otherwise worsened, if she couldn't do all the repetitions). In this case she feels proud, because the app tells her that this is the first time since a month that she improved in this exercise, motivating her to keep on going to the gym.

The rest of the workout is also guided, she just needs to follow the plan proposed by the app, if she wants to change a part of it, she can do this with a few clicks.

The rest of the workout is guided by scanning the RFID-Tags and so completing the workout, exercise by exercise.

2.6 Statistics and Achievements

After the workout Hanna has the option to see on which machines she did check in and what amounts of exercise she did. She can compare it to previous workouts to see her progress and also plan the next workout corresponding to what she did this time, for which the app also gives recommendations. This gives huge motivation to stay on goal for set achievements and to compare with friends or other people.

3. Implementation

3.1 Application structure

3.1.1 Login

On the first start of the App you will have to login to your account, which will be provided by your gym membership or by creating a new account selecting your gym. This account can be used to wirelessly enter the gym by scanning a QR code at the entrance, lock and unlock a locker by scanning a specifically generated QR-code at a central terminal without ever needing a gym ID or specific bracelet. It is possible to buy specific shakes, flavoured drinks or food at the gym and pay for those through the RFit app, automatically deducting the amount through the chosen payment method. This will be done with RFID, for improved security. The app would for example scan the RFID tag at the snack vending machine, establishing a connection to a server, which then completes your payment. The vending machine will communicate which product was chosen (determined by the number entered) and transmit this to the app via internet, and the app will deduct the charge for the products chosen. This is an example of how a vending machine could be turned into a smart object with the help of the cloud.

3.1.2 Workout creation

In the main menu you have the option to select and create workouts, where the "Select Workout" option offers a lot of predefined workout and individual exercises from a database, which also provides instructions and

links to videos for correct execution. If a desired exercise is missing you can manually add it. If enough people add an exercise not yet included in the RFit database, it gets added to the database. Also an option is offered where you can import workouts from either your personal trainer at the gym, the internet or your friends. Anyone can share their workouts, comment and vote on existing ones and you can choose the workouts that the community likes best, or simply the ones you prefer.

3.1.3 Workout execution

After creation you can chose an workout and it becomes active, which means all planned exercises are listed in an optimal order.
Activating an exercise of the current workout it either done by reading the corresponding RFID-tag on the machine or by checking it manually in case the RFID-tag is broken or not available, for example situps don't need a machine and don't have a tag. This enables you to simply go from exercise to exercise, without the need to tortuously search for suiting activities.
The app will automatically display optimal workout sets to reduce the likelihood of injury.

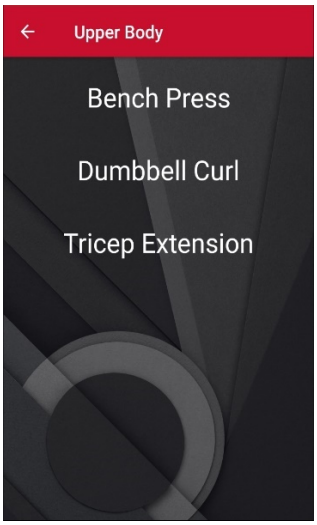

Figure 2: Workout Execution of the predefined workout "Upper Body", stating workouts which still have to be done

Also, if you want to cancel one exercise, for example if you cannot complete it or are injured, there is an option to complete it early or erase it from the current workout. As soon as an exercise is selected, specific information like weights, repetitions, break time and position adjustments are shown.

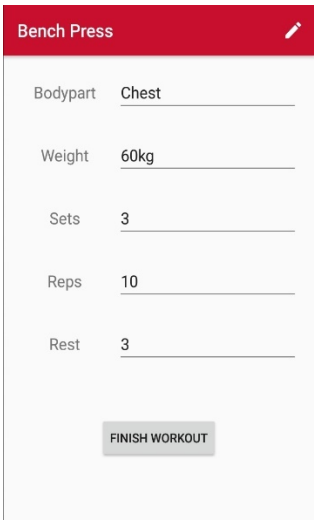

Figure 3: Specially suggested information of the workout "Bench Press" for a certain user, that can be adjusted by tapping the pencil in the upper right corner or marked as done by tapping "Finish Workout".

Furthermore, there is a description and links for examples and videos of correct execution by professional trainers.
If you need to find a machine or exercise area, a map of the specific gym with highlighted locations, provided by the gym, can be shown to help you find them. You can also update the exercise data for example if you improved yourself by increasing weights and repetitions. When checking the exercise, a timer becomes available where you can time your break to not forget the time. If you completed an exercise that has no time limit, you just press "Done" in the app and the exercise is checked off from the current workout and added to history. After completing a workout, its statistics are transferred to history and recommendations for next training dates and possible other workouts are shown. Additionally, a small summary will be shown of how much time you spent for the whole workout and, if this workout was done before, if you improved. There is also an option to show recommended drinks and foods connected to a workout, if it is desired by the user.

3.1.4 Friends

Another option in the main menu is friends, where you can see when your friends check in to the gym, or when they plan to go there. This way it is easier to coordinate yourself and find yourself a training partner, which is important for motivation. You can also see their workouts and improvements, in case you want to do the

same. The competition with others helps motivating yourself even more.

3.1.5 Analytics for the user

As mentioned before, the analytic part of the App shows a detailed training progress, where calories consumption and body weight or repetition increases are shown. On top of that you can scroll through your workout history and look at already performed workouts. You can compare your achievements with your goals and see if you have to improve your training or are already on a good way to achieve your targets. Additionally you can see your time in the studio to find out at which daytime you work out the most efficient.

3.1.6 Analytics for the studio

The gym itself can also use the app, but in "administrator mode", so more options become available. Since all data is saved to the gym's database, employees and superiors can access statistics of the app, such as usage of specific machines or amount of people in the studio at specific times.
This helps to plan shifts accordingly and to improve the selection of machines and exercises to most users' desires. An example would be a lot of people cancel the treadmill activity because all treadmills are always in use and they switch to different exercises, so the improvement would be to get more treadmills and save on exercises which are rarely or never used.
The app could - given that the user has agreed to it - give the gym demographic data on its members such as age or gender, which could in turn be used by the gym for marketing purposes.

3.2 RFID Tags and Reader

For recognizing workouts, RFit uses Radio-frequency identification (RFID) technology. This technology is used for automated, contactless identification and localization of objects. It needs a transponder which is placed on the object, which has a unique identity and a reader. It is possible to produce small transponders, which can even be printed on objects. Advantages are the small and cheap production of said transponders and the ease of the reading of the data. In the fitness studios these tags have to be glued on every machine that is part of the app, clearly visible for users. For reading of the data we use the RFID reader contained in every modern smartphone.

4. Future Developments

As app usage increases, more features will be implemented.

4.1 In-App-Features

There are certain days where you want to train more or less than your usual schedule, according to your time you have on that day. Special workouts for shorter or longer training as usual solve this problem and will be added to the workout selection.

Another optimization for the user is for the app to analyse and predict usage of machines to be able to intelligently adjust workout schedules to the current workload of the studio. It is very annoying for exercisers to have only machines on their list that are already blocked by other customers. The utilization can either be calculated by active workouts within the app, or with intelligent machines, that tell our servers when they are used and for how long the usage will last (more on that in 4.2. "Intelligent machines"). With accurate actual usage of machines and statistics of how many people are in the studio, the app will be able to predict when the best point of time is for an individual to go to train and tell you either during creating an activity schedule or by sending push-notifications that tell about unusual high or low current number of visitors.

In addition to studio workouts, more kinds of activities will be added to allow you to train even if your studio is overcrowded, or you just want to do activities outside, such as running, trekking or biking. Even sleep and food will be allowed to be recorded within the app, allowing RFit to create the perfect work schedule for you. You also will get a meal plan, personalized for you, to be even better matched to the training plan. By this, you won't need any other app than RFit. However, this is not a must, as you might not want to record all your activities or change your dietary habits.

A feature wanted by many athletes is to keep an eye on their heart rate, so support of wearables that are able to do so (Apple Watch, Fitbit, Android Wear) will be integrated and will allow

you to track your development over time, as lower heart rates at otherwise constant physical performance suggests an increase in overall performance as there is a more efficient distribution of energy in your body.

4.2 Intelligent machines

Intelligent machines bought by the studios will allow the app to implement features such as automatically adjusting specifications to the current setting in the app, either the default value of the workout or the one you entered, for example weight, height or difficulty of a machine. Intelligent machines will also be able to track your motions in high detail and tell you things you didn't do right, or you can improve. This is a huge advantage as it allows users to independently analyse and remove their mistakes without a personal trainer.

The next thing is to allow machines to track your workout and tell the app the details about achieved results. For now, the user has to manually start and end workouts, whereas intelligent machines can do this on their own, increasing the accuracy of workouts and break times. This could be established for all machines, for example dumbbells can be equipped with gyroscopes and energy harvesting technology, removing the need to recharge them.

A handy feature will also be to find your next machine more easily, if you cannot find any machine in your workout plan, you will simply be able to press on "Show me my next device", and the app will guide you there. The machine will additionally blink to make it even simpler for new customers to recognize their next training device.

As all this experience depends on your smartphone usage, running out of battery would be a depressing event, so for preventing this from happening, inductive charging stations will be included on the devices in positions where you also easily see your smartphone to follow your current workout process. By assuring constant smartphone usage, the machines will also be cheaper than competitor's products, as they can use the phone's screen to show information and don't need their own. The RFID Tag can be placed directly here, so that you can scan it even easier, by just placing your phone into the predefined spot.

5. Economics and pricing

The basic economic model and main source of profit is as following. The studio has one subscription model for people without the app, and one with the app, which will be called the app model from here on. The pricing and how much is charged more for the app model will depend on the studio. RFit simply takes 15% of each gym membership that is made with the app model.

The membership of the app model is paid in the application by conventional means (credit card, Paypal, bank transfer). This has the additional benefit of attracting users to the app, as modern payment methods offered by it are more desired and comfortable than standard bank transfers and standing orders, which is how gyms usually handle membership payments.

Analytics and usage data that the app collects are made accessible to the studios with no extra charge, this is already included in the 15% RFit takes.

The implementation and setup of tags etc. is done by RFit pro-bono (this is not a large cost and will reduce hesitation to join on the fitness studios' side).

The smart machines as detailed in Section 4.2 will have to be purchased by the fitness studios. This would prove to be a significant upfront investment that some studios will not take, so the option at this point in the future for RFit is to open own "smart-gyms", which will then mean to not license the RFit technology to third-party gyms anymore. This, however, is a hypothetical future point.

For all sales of snacks and drinks that are paid through the RFit app, RFit takes 15% of those profits.

Furthermore, there will be a premium subscription in the App. This premium subscription could include things such as: premium workouts curated by renown fitness personalities, diet plans and recipes, detecting flawed movements in the workouts (as detailed above) and notifying about those, the communication of whether the studio is too full, and another day or time would be better for training. More premium features are conceivable.