



## GYMNASIUM CALORIE SPECTRUM FLEXIBILITY AND MOBILITY OPTIMIZATION DESIGN

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### ABSTRACT

This research aims to produce Spektrum Gymnasium which is used as a progress monitoring tool and digital track of sports training that is accurate in building muscle in an efficient time and partners can monitor each customer's muscle-building exercise movements so that the calories wasted can be known, thereby increasing customer satisfaction. The research method begins with discussions with accompanying lecturers and partners. Implementation of activities begins with designing devices, collecting tools and software, and creating outputs in the form of Summit Health tool applications and manuals for using tools and applications. Partner assistance was carried out 6 times. Monitoring and evaluation were conducted to determine developments in using Summit Health tools and the Spectrum Gymnasium application. The sustainability of the Summit Health tool and the Spectrum Gymnasium application as a solution to problems and a guidebook can help in developing tools and applications to calculate calories for consumers independently. The results achieved are in the form of progress reports, final reports, guidebooks, social media accounts, Summit Health tools and Spectrum Gymnasium applications, scientific articles, Summit Health books, IoT-based Spectrum Gymnasium applications, IPR applications and activity publications. Conclusion Spektrum Gymnasium accurately monitors the progress of exercise training in building muscle efficiently. The monitoring feature makes it easier for gym partners to track exercise movements and calories burned, increasing customer satisfaction and exercise results, as well as strengthening customer loyalty and supporting sustainable business growth.

**Keywords:** Gym, Tools, Apps, Summit Gym and Summit Health

### INTRODUCTION

Indonesia has a population of 280.73 million people, in which the participation of

people who do sports is 31.39%. National Sport Development Index (SDI) data in 2020 which states that the Central Java region has a low

category of (33.1%), Semarang City with a medium category of (53.3%) and a physical fitness index included in the low category of (36.5%) (Monzera, 2023). One of the most popular sports is weight training (Djoko, 2020). Weight training can make the body ideal and athletic. Men are generally competing to gain muscle mass by participating in measured, regular and programmed weight training at fitness centres. Currently, the most popular fitness exercise is muscle fitness. Muscle fitness is the simplest and most effective exercise today. Strength training has become a physical activity favored by both teenagers and adults. This exercise is expected to shape the body or improve fitness. Society has individual appreciation for it (Prakoso and Irawan, 2022).

The results of the PKM-PI team's interview with the Summit GYM business owner partner, Mr Sumitro (65 years old) who is located at Jalan Grafika Raya No.93, Gedawang, Kec. Banyumanik, Semarang City, Central Java, who has opened the Summit GYM service business for 11 years since 2013. Opening hours are every Monday to Saturday from 05.30 - 21.00 WIB while Sundays from 07.00 - 17.00 WIB. (Figure 1,2).



Figure 1. Interview with Mr. Sumitro



Figura 2. Summit Business Owner Muscle Building

GYM provides simple fitness and wellness tools including T-Bar and Lat pull Down (back and shoulder muscle building tools), Smith Machine (strength training and muscle isolation), Rowing Machine (cardiovascular

training), Tight and Leg Press (works the inner and outer thigh muscles), Manual Biceps (works the biceps muscles), Front Chest Machine (works the chest muscles), Sit Up Bed (works the abdominal muscles), Pull Up Bar and Back Machine (works the arm and back muscles), Dumbell (works the body muscles). Trial-and-error gym workouts can lead to training mistakes and muscle injuries. Using training weights and equipment that do not match one's capacity can result in muscle injuries later on. Participants who initially aim for an ideal body may end up with muscle-related issues. There are many steps that can be taken for effective muscle-building exercises without a trainer. In this context, the researcher offers several types of exercises that can contribute to muscle development (Al Hafiz Sy and Edwarsyah, 2019).

Currently, the most popular fitness exercise is muscle fitness. Muscle fitness is the simplest and most effective exercise today. Strength training has become a physical activity favored by both teenagers and adults. This exercise is expected to shape the body or improve fitness. Society has individual appreciation for it (Tambing, Engka and Wungouw, 2020). Weight training will cause muscle enlargement due to: (1) the enlargement of muscle fibers (muscle hypertrophy), (2) an increase in the number of capillaries within the muscles, and (3) an increase in connective tissue within the muscles (S, Umar and Wellis, 2019).

The short-term effects of exercise include an increase in cardiac output, lung tidal volume, and muscle flexibility. The long-term effects of exercise include improved heart and respiratory muscle function, increased muscle mass, and bone mass. Exercise can be done anywhere and does not require many facilities (Tuerah, Rumampuk and Lintong, 2022).

There are an average of 20-30 customers per day with fees depending on whether the visit is daily or monthly. Daily visits are charged at Rp 15,000 per visit without treadmill and Rp 25,000 per visit for treadmill and gym. Monthly membership is charged at IDR 135,000 without treadmill and IDR

215,000 including treadmill and gym. The average partner earns an income of IDR 10 million - IDR 15 million per month.

Partners said that the fitness equipment owned is still simple and manual. Customers who want to train muscle building with the desired time target cannot be achieved with certainty, because the muscle building process in each person requires time, gender and different activities. Manual weight tools require calculating calories wasted during exercise, making it less optimal and still using feelings in increasing and increasing muscle mass. Manual calorie counting reduces the level of customer satisfaction because it cannot accurately monitor the progress of weight training and cannot know the amount of muscle built. Decreased customer satisfaction results in fewer customers coming to Summit Gym, reducing partner income.

The problem faced by partners is that there is no muscle-building weight facility that can accurately monitor the progress of training to increase muscle mass, then the problem solving plan of the PKM-PI team provides a solution in the form of Spektrum Gymnasium tools and applications that can determine muscle building and fitness used with the accuracy of movement and know the calories wasted in the muscle building process by utilising Internet of Things-based proximity sensors connected to smartphones can make it easier for customers and partners to observe the accuracy of body movements, the number of calories wasted and the digital footprint of the muscle-building process can be monitored by the coach. The existence of the Spektrum Gymnasium application with the help of proximity sensors connected to smartphones can help partner problems in seeing the progress of muscle building and calories wasted during training, so that they are able to see track record results and can be monitored by trainers who have the potential to increase satisfaction and the number of customers in line with the increase in partner income.

This research aims to produce Spektrum Gymnasium which is used as a progress monitoring tool and an accurate digital footprint of sports training in muscle building

with efficient time so that it has an impact on increasing income and partners are able to monitor the movement of muscle building exercises for each customer so that calories wasted can be known so as to increase customer satisfaction.

## RESEARCH METHOD

The research method starts from the announcement of PKM funding by coordinating with the accompanying lecturers regarding the implementation of activities and the design of activities and discussing with partners regarding the implementation of activities (Figure 3,4).



Figure 3. Discussion with the Supervising Lecturer



Figure 4. Discussion with Mitra

### Device Design

The implementation of the activity begins with the design of devices in the form of summit health tools and gymnasium spectrum applications. The tool is designed to have a proximity sensor to detect each exercise repetition. The application is designed to have repetition features, exercise history, exercise type, consultation and calorie calculation.

### Tool and Software

The collection of tools and software can be seen in Table 1.

Table 1. Tool and *software*

Tool	<i>Software</i>
------	-----------------

LCD 12C	Switch	Figma	Flutter
Sensor Proximity	PCB	Android Studio	Creative Slicer
Baterai 9V	ESP-32	Visual Studio Code	Autodesk

### Tool, Application and Guidebook Development

Making outputs consisting of summit health tools, gymnasium spectrum applications and manuals. Making the summit health tool has 3 stages (Figure 5).



Figure 5. Flowchart of tool manufacturing

Design creation is done using autodesck software and sliccer to create a 3D form consisting of body and pcb circuit with eagle software (Figure 6).

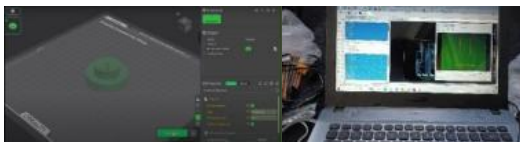


Figure 6. Tool design and PCB circuit

The body was printed using a 3D printer and the PCB frame with a circuid board printer (Figure 7).

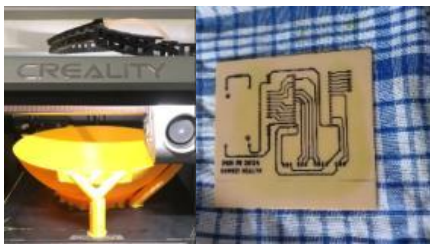


Figure 7. PCB Body and Frame Printing

Assembly of the device with components consisting of proximity sensor, LCD-32, ESP, battery and PCB circuit (Figure 8). The sensor used in this device is a proximity sensor. The proximity sensor operates at a voltage between 10 – 30 VDC and a voltage of 100 – 220 VAC (Setyawati, T., & Rahmadewi, 2023).



Figure 8. Summit Health Tool Assembly

The creation of the Spektrum Gymnasium application has 3 stages (Figure 9).



Figure 9. Flowchart of Application Development

Designing the Spektrum Gymnasium application using figma software to facilitate the use of the application consists of menus, sub menus, backgrounds and features such as profiles, exercise reps, exercise history, calorie calculations and consultations (Figure 10).



Figure 10. Application design

Coding in the Spektrum Gymanisum Application uses the C++ language through Visual Studio software (Figure 11).

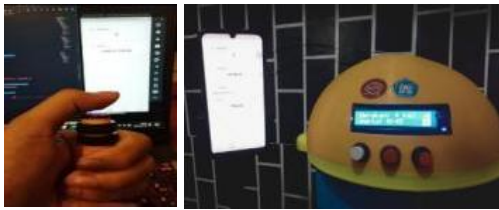


Figure 11. Coding

The Gymnasium Spectrum application is connected to the summit health tool component and extends the application file with android studio so that the Gymnasium Spectrum application can be used properly on a smartphone.

### Tool Testing

Testing the tool by connecting the tool to the application to see the status of the tool in detecting reps and counting calories with monitoring from a wifi-connected application (Figure 12). An application that is connected to Android with an operating system on a mobile phone that is open-source and Linux-based. Android provides an open platform, making it easier for developers to create their own applications (Aryani, Y. & Fajri, 2022).



**Figure 12.** Tool testing

An application created using the Internet of Things (IoT) system, which is an idea that extends the benefits of constant internet connectivity. By utilizing data capture and communication, IoT connects physical and virtual objects, allowing real-world objects to communicate through networks and the internet (Sembiring, J & Sari, 2022), making it easier for partners.

**Guide Book**

The manual for using the gymnasium application and summit equipment contains features contained in the application and their functions, how to use and maintain the equipment aims to facilitate partners in operating the application and equipment (Figure 13).



**Figure 13.** Guide book

**Mentoring**

The first assistance of the PKM-PI team introduced the summit health tool and the gymnasium spectrum application and provided a guidebook to partners as well as an introduction to the features of the gymnasium spectrum application and tools (Figure 14).



**Figure 14.** First mentoring

The second assistance of the PKM-PI team provided information on how to use the gymnasium spectrum application and install the application to the partner's smartphone (Figure 15).



**Figure15.** Second mentoring

The third assistance of the PKM-PI team provided information on how to use the summit Health tool connected to wifi (Figure 16).



**Figure16.** Third mentoring

The fourth assistance of the PKM-PI team synchronised the gymnasium spectrum application and summit health tool to the gym equipment (Figure 17).



**Figure17.** Fourth mentoring

The fifth assistance of the PKM-PI team applied the Summit Health Spektrum Gymnasium tools and applications (Figure 18).



**Figure 18.** Fifth mentoring

The sixth assistance of the PKM-PI team applied the application and tools to consumers at summit gym in calculating the number of calories (Figure 19).



**Figure 19.** Sixth mentoring

**Monitoring and Evaluation**

Monitoring and evaluation were carried out by the PKM-PI team together with accompanying lecturers to find out the progress of the use of tools and the application of the gymnasium spectrum that has been carried out by partners. The results of monitoring partners said they had applied Spektrum Gymnasium to consumers in

mid-June. Tools and applications are very useful in overcoming the problem of accurately targeting time to gain muscle mass and calculating calories wasted during muscle-building exercises. Evaluate the situation that occurs and provide solutions and see the ability of the summit Health tool and the gymnasium spectrum application as an accurate solution to partner problems that have the potential to increase partner income (Figure 20).



Figure 20. Monitoring and evaluation Sustainability

The sustainability of the activity is expected that partners continue to implement the summit Health tool and the gymnasium spectrum application so that the problem of target time to increase muscle mass accurately and count calories during muscle building exercises has an impact on increasing income. The guidebook helps partners use tools and applications and maintenance independently so that partners are a model for Gyms in Indonesia, especially in Semarang.

## RESULT AND DISCUSSION

Summit Health tools and Spektrum Gymnasium applications as a solution to partner problems have the advantages listed in Table 1.

Table 1. Summit health gymnasium advantages

Komponen	Keunggulan
Alat Summit Health	Mendeteksi gerakan latihan dengan sensor proximity
Aplikasi Spektrum Gymnasium	Pemantau kemajuan dan jejak digital yang akurat dalam pembentukan otot serta jumlah kalori dengan waktu efisien berdampak pada kenaikan <i>income</i>

The achievement of the PKM-PI Team activities has reached 93% resulting in mandatory outputs, namely progress reports, final reports, partner handbooks and social media accounts. Additional outputs are summit Health tools and gymnasium spectrum applications, scientific articles, summit Health books: IoT-based gymnasium spectrum applications, application IPR and mass media publications which can be seen in Table 2.

Table 2. Results achieved

Hasil	Gambar
Laporan Kemajuan yang berisikan hasil kegiatan yang telah dilaksanakan	<p>2.1.1. Latar Belakang Indonesia memiliki jumlah penduduk sebesar 280,77 juta jiwa (Badan Pusat Statistik, 2021), tingkat indeks nya pasangan merupakan yang melanda di antara negara-negara di 191. Data Spora Development Index (SDI) nasional tahun 2020 yang menunjukkan bahwa Jawa Tengah memiliki tingkat rendah sebesar 133,37%, dan Semarang dengan tingkat rendah sebesar 133,37% dan tidak tergolong prestasi tersebut. Indeks tingkat rendah sebesar 136,24 (Kusumawati, 2021). Salah satu tantangan yang harus dihadapi masyarakat adalah latihan beban (Oxley, 2020). Latihan beban merupakan salah satu jenis olahraga. Latihan beban bertujuan untuk meningkatkan massa otot dengan latihan beban yang terdiri dari berbagai jenis latihan di antara lain: angkat beban, latihan kardio, dan latihan kekuatan.</p> <p>2.1.2. Maksud dan Tujuan Maksud dari kegiatan ini adalah untuk meningkatkan pengetahuan dan keterampilan mitra dalam menggunakan alat Summit Health dan aplikasi Spektrum Gymnasium. Tujuan dari kegiatan ini adalah untuk meningkatkan kemampuan mitra dalam menggunakan alat Summit Health dan aplikasi Spektrum Gymnasium.</p> <p>2.1.3. Manfaat Manfaat dari kegiatan ini adalah untuk meningkatkan pengetahuan dan keterampilan mitra dalam menggunakan alat Summit Health dan aplikasi Spektrum Gymnasium.</p>
Laporan Akhir yang berisikan seluruh hasil kegiatan dan rekapan kegiatan dari awal hingga akhir	<p>2.2. Tahap Pelaksanaan 2.2.1. Pendekatan Perancangan Pendekatan perancangan ini menggunakan Pendekatan Perancangan Sistem (PPS) dengan menggunakan alat Summit Health dan aplikasi Spektrum Gymnasium. Pendekatan ini digunakan untuk meningkatkan kemampuan mitra dalam menggunakan alat Summit Health dan aplikasi Spektrum Gymnasium.</p> <p>2.2.2. Tahap Pelaksanaan Tahap pelaksanaan ini dilakukan dengan menggunakan alat Summit Health dan aplikasi Spektrum Gymnasium. Tahap ini bertujuan untuk meningkatkan kemampuan mitra dalam menggunakan alat Summit Health dan aplikasi Spektrum Gymnasium.</p>
Buku Pedoman Mitra yang berfungsi sebagai pedoman dalam menggunakan alat Summit Health dan aplikasi Spektrum Gymnasium	<p>2.3. Tahap Penyelesaian Tahap penyelesaian ini dilakukan dengan menggunakan alat Summit Health dan aplikasi Spektrum Gymnasium. Tahap ini bertujuan untuk meningkatkan kemampuan mitra dalam menggunakan alat Summit Health dan aplikasi Spektrum Gymnasium.</p>

<p>Akun Media Sosial instagram summit_health.id</p>	
<p>Alat Summit Health dilengkapi dengan sensor proximity dan Aplikasi Spektrum Gymnasiu yang dapat memantau dan melihat progres latihan</p>	
<p>Buku Summit Health Spektrum Gymnasium berbasis IoT yang sudah memperoleh ISBN dan bersertifikat HKI</p>	
<p>HKI Program Komputer Summit Health</p>	
<p>Kegiatan yang telah dilaksanakan dipublikasi di Kompas TV</p>	

## CONCLUSION AND SUGGESTION

The results of the implementation of the summit health tool and the gymnasium spectrum application obtained that the tools and applications can help see the development of muscle building and calories wasted during training, so that they can see the results of track records and can be monitored by trainers who have succeeded in increasing partner satisfaction and income. Suggestions that can be given in the form of partners can apply and continue the use of summit health tools and the gymnasium spectrum application in order to see the development of muscle building and calories wasted during training.

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