



Design of a Wearable Membership ID for the Fitness Center

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ABSTRACT

The development of technology has brought major changes in aspects of life, including in the field of sports and fitness. Internet of Things (IoT) technology can improve efficiency and experience for users. Many fitness centers in Indonesia have several problems, such as fitness managers having difficulty distinguishing which member still has active memberships and which have expired ones while they are accessing the gym. The problems occur due to still adopting a manual system in terms of managing membership, granting access rights, and supervision. Therefore, this study designs and develops an integrated system that has a wearable membership ID using an nRF24 transceiver and an IoT-based Master Device to overcome these problems. The results of this work show a fully developed system that allows online registration, solid data management, seamless access granting, and real-time user safety monitoring. The performance of the system has 100% accuracy around 65 meters of Line of Sight (LOS) coverage in distinguishing between active and expired membership for access granting, which is good for improving the quality of service and the overall member experience in the future application.

Keywords: Fitness center, Internet of Things, monitoring, nRF24, wearable device

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INTRODUCTION

The Internet of Things (IoT) has revolutionized various industries, including fitness and health, by enabling real-time data collection, analysis, and automation (Syach & Satino, 2024). IoT devices facilitate communication and data exchange, becoming integral to modern lifestyles, particularly fitness (Zohari et al., 2024). However, many fitness centers, like Natama's, still rely on manual systems for

member registration and payment, leading to inefficiencies in managing member data, such as difficulty tracking active or inactive members (Faizal, 2019).

Manual systems are prone to errors, including data loss or corruption, which can impact business operations (Liliana et al., 2021). Despite some advancements, such as the use of website-based information systems (Ridwan & Halim, 2024), integration and synchronization with other tools remain challenges. Moreover, obtaining real-time data on visitor numbers, active members, and sales is crucial for strategic decision-making (Ramadhana et al., 2021). To address these issues, a Membership and Monitoring System for Fitness Centers was developed, offering online registration and monitoring tools to streamline member management and improve operational efficiency (Kurniawan et al., 2024).

PROBLEM STATEMENT

Fitness centers, like Natama’s, struggle with manual membership management, including difficulty tracking active members and limited real-time data access. These error-prone, time-consuming systems lead to data loss and operational inefficiencies. Therefore, an automated IoT-based system is needed to streamline membership management, track activity, and enhance communication and efficiency.

RESEARCH QUESTIONS

How effective is the wearable device in communicating with the master device, and what is the success rate of verifying membership data and granting access, considering different ranges and orientations?

The wearable device communicates effectively with the master device up to 65 meters (80% success rate), verifying membership data with 100% accuracy. Communication remains stable at shorter distances (30 meters) and various orientations, but drops beyond 70 meters (Tables 1–2).

Table 1
Master device coverage measurement result at 0°

Range (m)	Testing Count and Success Rate		
	Scan (Times)	Found (times)	Success Rate (%)
30	20	20	100
68.3 ^a	20	16	80
70	20	0	0

^aSpecial range sampling to see coverage limit with a success rate above 80%

Table 2
Master device coverage measurement result at 90°

Range (m)	Testing Count and Success Rate		
	Scan (Times)	Found (times)	Success Rate (%)
30	20	20	100
65.6 ^b	20	17	85
70	20	0	0

*Special range sampling to see coverage limit with a success rate above 80%

CONCLUSION

The IoT-based Membership and Monitoring System improves fitness center membership management by automating the process. The wearable device reliably communicates with the master device up to 65 meters, with 100% success verifying membership data. Communication quality declines beyond 70 meters. The web server efficiently manages user data, enhancing operational efficiency and membership tracking accuracy. This system significantly improves traditional manual processes.

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