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IoT and AI for Silambam Martial Arts: A Review

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Abstract

Silambam is a traditional martial art from Tamil Nadu, India. It is a stick-fighting art that has been practiced for centuries. In recent years, there has been growing interest in using technology to enhance the practice and promotion of Silambam. One way to do this is to use the Internet of Things (IoT). IoT devices can be used to collect data on Silambam practitioners' movements and performance. This data can then be analysed using artificial intelligence (AI) to provide insights and recommendations to practitioners. For example, IoT sensors could be attached to Silambam sticks to track the number of rotations, speed, and force of each strike. This data could then be used to provide feedback to practitioners on their technique and progress. AI could also be used to develop personalized training programs for Silambam practitioners. For example, AI could analyse a practitioner's data to identify areas where they need improvement and then recommend specific exercises or drills. In addition to enhancing the practice of Silambam, IoT and AI could also be used to promote the art to a wider audience. For example, IoT-enabled Silambam sticks could be used to create interactive training games or simulations. Overall, IoT and AI have the potential to revolutionize the way that Silambam is practiced and promoted. By using these technologies, we can make Silambam more accessible, engaging, and effective for practitioners of all levels.

Keywords: Silambam, Internet of Things, Artificial Intelligence, Machine Learning

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1. Introduction

Silambam is a traditional Indian martial art that has been practiced for centuries. It is a complex and demanding art form that requires a high level of physical fitness, mental discipline, and coordination. In recent years, there has been growing interest in using technology to improve the teaching and practice of martial arts. Technology can be used to track and analyse the physical and mental health of Silambam practitioners. This data can then be used to develop personalized training programs, identify and correct technique errors, and track progress over time. For example, sensors can be used to track the movement of the stick during Silambam practice. This data can then be used to analyse the practitioner's technique and identify areas for improvement. Artificial intelligence (AI) algorithms can also be utilised to create individualised training plans that are catered to the requirements and objectives of the person. In addition to tracking physical performance, technology can also be used to track the mental health of Silambam practitioners. For example, wearable devices can be used to monitor blood pressure, heart rate, and sleep quality. This data can then be used to identify signs of stress, anxiety, or depression. AI algorithms can also be used to develop interventions to help practitioners manage their mental health.

1.1. Benefits of learning silambam

Silambam is a traditional Indian martial art that offers a wide range of benefits for practitioners, including improved physical fitness, reduced stress, and anxiety, enhanced mental focus, increased self-confidence, and improved self-defence skills. It is also a valuable skill to learn for self-

defence, especially for women. Silambam is a great way to improve your overall well-being and live a healthier and happier life.

1.2. Modern Era in Silambam

Present day Silambam is taught on martial arts schools by Silambam Aasaans (Masters) to the students. Like Belt grading system in karate and other martial arts. Silambam masters have introduces belt grading system for the students to grade their level of proficiency in Silambam.[1]

1.3. Existing gaps and related works

In recent years, Research on the relationship between martial arts and physical fitness has gained prominence. Application of Internet of Things and artificial intelligence for smart fitness: A survey [2] discuss about how technology induced in Fitness can create great advantages to the community. Analysis of the Effect of Martial Arts on Students' Physical and Mental Health Based on Internet of Things Technology [3], this talks about effect of Martial arts on students physical and mental health and Influence of Silambam practices and yogic practices on speed and flexibility among U-17 female sprinters talks about the influence and its positive impact for Silambam and Yoga Practitioners.

2. Research done on silambam so far

There are numerous research projects done on Silambam from Influence of silambam practices on speed and flexibility[4][5] to Designing and developing textile prints from Silambam pose to Effect of silambam practice on selected Bio motor variables among college girls[5] Though this research has helped Silambam to popularize among the youth, the need of the hour is the technological intervention in Silambam to make it more appealing to younger and tech savvy people worldwide.

2.1. Way forward:

Using technology to promote our indigenous martial art Silambam will help to preserve our cultural heritage and make it accessible to a global audience. This will raise awareness of Silambam among the youth of our nation and the world. The technologies used in this research are IoT sensors, AI and ML, Javascript, and Amazon web services.

2.2. IoT-Enabled Smart Silambam Stick for Fitness Tracking:

The fitness industry is not an exception to how quickly the Internet of Things (IoT) is changing the way we work and live. IoT-enabled gadgets are being used to monitor a variety of parameters, including heart rate, calories burnt, and sleep quality. One area where IoT has the potential to make a big impact is in the traditional martial art of Silambam. A Smart Silambam Stick equipped with sensors to track the user's movements and heart rate can be used to track the number of calories burned during a training session.[6] This information can be used to set fitness goals and track progress, get feedback on technique, and gamify Silambam training. Overall, an IoT-enabled Smart Silambam Stick possesses the capacity to completely transform the way Silambam is taught and practiced.

2.3. Technical Details:

The Smart Silambam Stick would be equipped with the following sensors:

- Accelerometer: To track the movement of the stick
- Gyroscope: To track the orientation of the stick

The sensors would be embedded in the stick and connected to a microcontroller. The microcontroller would be responsible for collecting the sensor data and transmitting it to the smartphone app via Bluetooth or Wi-Fi.
The smartphone app would use machine learning algorithms to calculate the number of calories burned by the user during the training session. The app would also provide users with feedback on their technique and track their progress over time.

3. Data collection and analysis

The data collected from Smart Silambam Sticks can be used to gain valuable insights into the user base, such as:

- Who uses Silambam?
- How often do they use it?
- What are the benefits they get from using it?
- What are their pain points?

This information can be used to improve the Silambam experience for users and to develop new products and services that meet their needs.
For example, the data could be used to develop personalized Silambam training programs for users, identify and correct common Silambam technique errors, track the progress of Silambam athletes, and conduct research on the health benefits of Silambam.

3.1. Research outcome

- To scientifically prove the health benefits of practicing Silambam
- To make Silambam more accessible and engaging to a wider audience by using technology

- To increase participation in Silambam, which can lead to a healthier and more active society
- To educate students about their rich traditional heritage and promote Silambam as a viable alternative to Western fitness methods
- To develop new technologies and products that make traditional sports more user-friendly and attractive

These research outcomes are all aligned with the goal of promoting Silambam and other traditional sports. By scientifically proving the health benefits of Silambam, using technology to make it more accessible and engaging, and educating students about its rich cultural heritage, we can increase participation in Silambam and improve the overall health and well-being of society.

Additionally, by developing new technologies and products that make traditional sports more user-friendly and attractive, we can help to preserve and promote these important cultural traditions for future generations.

4. Proposed Approach

4.1. IoT Sensor

An IoT sensor can be attached to the inside of a Silambam stick to track the user's movements and heart rate. The sensor can be programmed to count the number of times the user swings the stick. This data can then be transmitted to a cloud database via Bluetooth or Wi-Fi.

4.2. Machine Learning

The caloric data of all users who use the application can be stored on a cloud server. This data can then be processed using machine learning algorithms to better understand the effectiveness of the benefits of Silambam and to classify users based on gender and age. This information can be used to improve the Silambam experience for users and to develop new products and services that meet their needs.

4.3. Mobile Application

A mobile application can be developed for users to view their caloric data and other analytical data, such as how much time they have spent practicing Silambam over a period of time. Users can also customize the app to meet their physical training needs. For example, they can set fitness goals to be achieved in a week or a month.

4.4. Technical details

The IoT sensor used in the Silambam stick could be a combination of an accelerometer, gyroscope, and heart rate sensor. The accelerometer would track the movement of the stick, the gyroscope would track the orientation of the stick, and the heart rate sensor would track the user's heart rate.
The sensor data would be transmitted to a smartphone app via Bluetooth or Wi-Fi. The smartphone app would use machine learning algorithms to calculate the number of calories burned by the user during the training session. The app would also provide users with feedback on their technique and track their progress over time.
The mobile application could be developed using a variety of platforms and technologies, such as Android, iOS, and Flutter. The application would need to be integrated with the cloud database to store and retrieve user data.

4.5. Intended benefits

- Track your fitness progress and be aware of your physical fitness level using the Silambam stick.
- Scientifically prove the health benefits of practicing Silambam.
- Make Silambam more accessible and engaging to today's tech-savvy youth.
- Create a new business model for ancient sports.

5. How it works

The smart Silambam stick is equipped with sensors that track your movements and heart rate. This data is then transmitted to a smartphone app, which uses machine learning to calculate the number of calories you burn during your workout. The app also provides feedback on your technique and tracks your progress over time.

6. Benefits for users

- **Track your fitness progress:** The smart Silambam stick can help you track your fitness progress by tracking the number of calories you burn and your heart rate during your workouts. This information can help you set fitness goals and track your progress towards those goals.

- **Be aware of your physical fitness level:** The smart Silambam stick can also help you be more aware of your physical fitness level. By

tracking your heart rate and the number of calories you burn, you can get a better understanding of how your body is responding to exercise.

- **Make Silambam more accessible and engaging:** The smart Silambam stick can make Silambam more accessible and engaging to today's tech-savvy youth. By using technology to track fitness progress and provide feedback, the smart Silambam stick can make Silambam more fun and motivating.

- **Create a new business model for ancient sports:** The smart Silambam stick can help to create a new business model for ancient sports. By providing a smart device that can be used to track fitness progress and provide feedback, the smart Silambam stick can make ancient sports more attractive to a wider audience.

7. Technologies involved

- **IoT Sensor:** An IoT sensor, such as an accelerometer, gyroscope, and heart rate sensor, can be attached to the inside of a Silambam stick to track the user's movements and heart rate. The sensor data can then be transmitted to a smartphone app via Bluetooth or Wi-Fi.

- **Python language:** Python is a versatile programming language that can be used for a variety of tasks, including data science, machine learning, and web development. It is a good choice for developing the mobile application and the cloud backend for this project.

- **AI/ML algorithm using Tensorflow:** Tensorflow is an open-source machine learning library that can be used to develop and train a variety of machine learning models. In this project, Tensorflow can be used to develop a machine learning model to predict the number of calories burned by the user during a Silambam training session.

- **Mobile application development using opensource JS frameworks:** A variety of open-source JavaScript frameworks, such as React Native and Flutter, can be used to develop the mobile application for this project. These frameworks allow developers to build native mobile applications for iOS and Android using a single codebase.

- **Amazon web service to store data in cloud database:** Amazon Web Services (AWS) provides a variety of cloud services, including database storage, computing power, and machine learning services. In this project, AWS can be used to store the user data collected from the IoT sensor and to train and deploy the machine learning model.

- **Analytics platform such as Google analytics to track the usage:** Google Analytics is a web analytics platform that can be used to track the usage of websites and mobile applications. In this project, Google Analytics can be used to track the usage of the mobile application, such as how many times the application is viewed, most viewed page or section in the application, time they spent on the application, and so on.

8. Technical Implementation

The following is a high-level overview of the technical implementation of the proposed system:

- The IoT sensor attached to the Silambam stick will collect data on the user's movements and heart rate.
- The sensor data will be transmitted to a smartphone app via Bluetooth or Wi-Fi.
- The smartphone app will use the TensorFlow machine learning library to predict the number of calories burned by the user during the training session.
- The smartphone app will also store the user data in a cloud database hosted on AWS.
- The Google Analytics platform will be used to track the usage of the mobile application

By following these considerations, a robust and effective system can be developed to track the fitness benefits of practicing Silambam.

9. Conclusion

The proposed approach possesses the capacity to completely transform the way Silambam is taught and practiced. By

using IoT sensors and machine learning to track user data, we can develop personalized Silambam training programs, identify and correct common technique errors, track the progress of Silambam athletes, and conduct research on the health benefits of Silambam. Additionally, by making Silambam more accessible and engaging through the use of mobile technology, we can reach a wider audience and help to promote this ancient martial art.

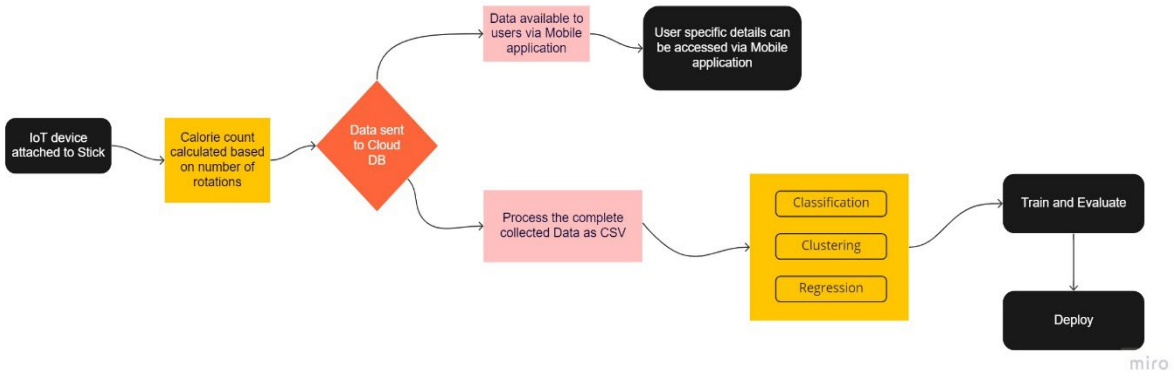

Figure 1. Flowchart of the intended approach

References

[1] Alireza Farrokhi, Reza Farahbakhsh, Javad Rezazadeh, Roberto Minerva, Application of Internet of Things and artificial intelligence for smart fitness: A survey Computer Networks ,Volume 189,107859, (2021)

[2] Jinling Li, Evaluation Method of Athletes Special Physical Fitness based on Internet of Things SciELO ,Rev Bras Med Esporte 27 (spe2), (2021)

[3] Zhiqiang Qu, Analysis of the Effect of Martial Arts on Students' Physical and Mental Health Based on Internet of Things Technology, Hindawi, Volume 2022, 8663157 (2022)

[4] Arunachalam A, Thenpandaya thamizhyarin silambam varalaruim, Adimuraikalam, 1995 | 1:9 (1995)

[5] Dr.Selvam M, Dr. Ganesh Babu T, Influence of silambam practices and yogic practices on speed and flexibility among U-17 female sprinters, International Journal of Physical Education, Sports and Health, volume 3(2), pp136-139, 2394-1693, (2016)

[6] K.Gomathi, KV Arunkumar, Ponsabareeswar, Designing and developing textile prints from silambam poses, International Journal of Home Science; volume 7(3): pp-76-82, (2021)

[7] P Jayalakshmi, K Sreedhar, Mahadevan, Effect of Sedikuchi silambam practice on selected Biomotor variables among college girls, International Journal of Research in Economics and Social Science | Volume 6, Issue 5, ISSN 2249-7382, (May, 2016)