# GymCoin Whitepaper

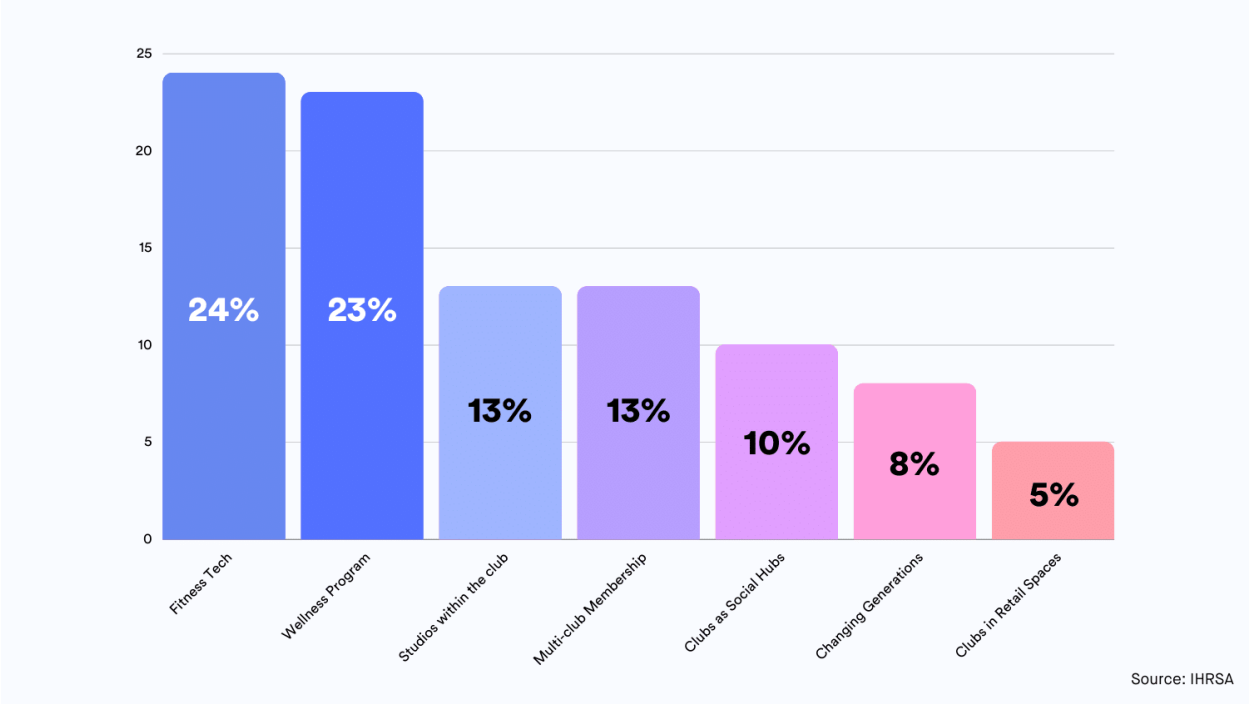
## Abstract

Nowadays, physical fitness and bodybuilding have been unprecedentedly popular. While it is usually easy for people to start exercises or diets, they may find it difficult to persevere for lack of inner-drive. There are many factors contributing to this phenomenon – busy schedules, intense training plans, lack of workout buddies, etc. All these factors gradually lead to a loss in motivation, causing people to become more reluctant to daily exercise, and eventually stop working out completely. Even though pre-workout products can relieve this unwillingness, its effect is temporary and can lead to dependence on the product. With the development of technology and the global market, blockchain technology and cryptocurrency inspired us to develop a blockchain-based application that incorporates exercising, entertainment, and socialization through the implementation of a platform that rewards users for actively staying fit. By creating such a platform that targets people's demand for personalized socializing and motivation for exercising, we expect to promote our GymCoin with a high socio-economic value and, broadly, a healthy lifestyle for people as well as the growth of the gym industry.

## 1. Introduction

The idea is that our users can connect to their smart devices like watches/rings, choose their desired type of exercise, and trace their heart rate & time for calories consumption. They will be rewarded a certain amount of GymCoins for calories burnt. GymCoins can then be used in a NFT platform where users can claim ownership to images of their interest and trade with each other. We could also potentially explore a gaming platform. Note that one can also trade GymCoins for cash with other users.

Data storage and management as well as the trading process will be done on the Ethereum blockchain using Solidity and the User Interface will be derived from the Scaffold-ETH application. We expect this integrated platform to promote the circulation of GymCoin within its community and increase GymCoins' value through interactions. With the rise of fitness tech and the gradual maturity of blockchain technology, we expect GymCoin to bridge the two markets.




*Top Fitness Trends of 2019*

## 2. Why (GymCoin on) Blockchain

### Incentive Reward System

- GymCoin is a **sustainable incentive system** that rewards exercise
    - The incentive is so far monetary, but can also be expanded to others
    - Similar concept can be applied to any currently not rewarded activities such as public service

- Due to proof of work and immutability, the incentive won't be tampered with
- GymCoin as Fungible Token (ERC20): can be exchanged among users
- Characters as Non-Fungible Token (ERC721): unique digital identifier that can't be exchanged for similar kinds

It serves as vending machines, with secure transactions, lower compliance costs, and higher transaction speed.

- **Authentic** transaction verified and confirmed by participants:
    - Transactions can only go through if it's verified by all parties involved
- **Immutable** transactions:
    - One a transaction goes through, it can't be altered or deleted
- **Decentralized** data with no fee required:
    - Users directly interact with each other through addresses without the need to go through intermediary parties
- **Non-intermediary** rewards for producers:
    - No transaction or commission fee generated since no intermediary

**Feasibility** – competitive among other decentralized industrial projects.

- Banking/Fintech:
- Healthcare/Insurance:
- Supply Chain Management:
- Gaming:

**Traceability** – efficient contract management and data query.

## 3. Core Concept

Users: the core of GymCoin. We focus on the quantity and quality of users and strive to add socio-economic values to our users by implementing an interactive platform to motivate users and as well as smart contracting for monetary incentive. There are naturally two types of users—producers and consumers. A consumer is one that participates in daily work-outs, purchases gym tutorials, exchanges for GymCoin rewards, claims ownership to interesting collections of images, and interacts with others. A producer is one that trades GymCoins or shares his exercise experience and expertise with the exchange of GymCoins.

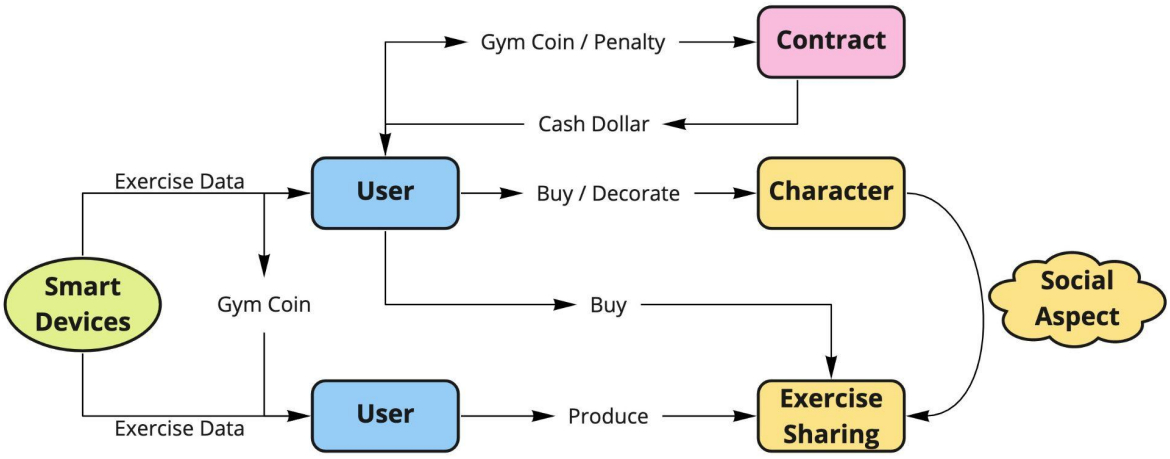
Smart Contracts: a monetary incentive to users, rewarding users with GymCoins and cash. We developed layered plans for cash bonuses catered to different needs of our users (Specified later).
Crypto-currency: crypto-transactions allowed between contracts and users to create a safe environment. Liquidity is preferred and promoted by the mechanisms.

Scaffold-ETH: a good visualization tool for smart contracts with diverse methods for User Interface. It would be the place of our main page, attracts users to interact with our smart contracts and enables users to query their current status/collections.

## 4. GymCoin Mechanism

- Access smart devices like watches/rings or running machines, choose your own type of exercise, and trace your heart rate & time for Calories.
- Get GymCoins for a certain amount of Calories, with a daily limit of 10 GymCoins.
- GymCoins can be transferred and have no amount limit.
- Multiple applications:
    - Layered Plans for cash **bonus**:
        - Get 5 extra coins for 25 GymCoin per week and 3 penalty
        - Get 7 extra coins for 30 GymCoin per week and 4 penalty
        - Get 9 extra coins for 35 GymCoin per week and 5 penalty

    - Post about your exercise experience and share with your friends!




*GymCoin Mechanism*

## 5. GymCoin Basic Functionality

### Register

```
function Register(bytes32 userID, uint [] memory deviceIDs) public {
        User storage sender = Users[msg.sender];
        require(!sender.registered, "You have already registered");

        sender.userID = userID;
        sender.deviceIDs = deviceIDs;
        sender.balance = 0;
        sender.balance_reset = 0;
        sender.contractID = 0;
        sender.registered = true;
  }
```

The function takes in the parameter userID and deviceIDs. Before user workout, they need to register using their unique userID with deviceIDs. By doing that, user can earn their gymcoin through exercise to corresponding userID and account. DeviceIDs are required because every exercise using non-register device will be invalid.

### Add_device

```
  function add_device(uint newDeviceID) public {
        User storage sender = Users[msg.sender];
        require(sender.registered == true, "You have not registered.");

        sender.deviceIDs.push(newDeviceID);
  }
```

The function takes in the parameter deviceIDs, which is to register the new device into the corresponding user account. The function will automatically connect to the address of the person who call the functions.

**Add_exercise**

```
    function add_exercise(bytes32 userID, uint deviceID, uint heart_rate, uint
workout_time_in_minutes, uint calories) public {
        User storage sender = Users[msg.sender];
        require(sender.registered == true, "You have not registered.");
        require(sender.userID == userID, "Wrong User ID");

        // Check if the device is recorded
        bool Contain = false;
        for (uint i=0; i < sender.deviceIDs.length; i++) {
            if (deviceID == sender.deviceIDs[i]) { Contain = true; }
        }
        require(Contain == true, "Must use the correct device");
        // Reward
        sender.balance += reward(heart_rate, workout_time_in_minutes, calories);
  }
```

The function takes in the parameters userID, deviceIDs, heartrate, workout time in minutes and calories. It is the major function for user to earn gym coin through exercise. Also, we have created our unique formula for gym coin earning.

$$gymcoin = \frac{calories * workouttime * 60}{heartrate * 2000},$$

For the denominator, we decide to divide by the heartrate because we want to balance off the workout between weightlifting and cardio. People who do cardio tend to have a higher heart rate, so dividing by heartrate also will be fair to those people who do cardio. For the nominator, as people have a longer workout time and consume more calories, they will earn more gym coin, which follows the gymcoin reward mechanism.

**Transfer**

```
  function transfer(address receiver, uint amount) public returns (bool) {
        // Teansfer GymCoin
            require(Users[msg.sender].registered && Users[receiver].registered, "Both
users must be registered.");

        require(Users[msg.sender].balance >= amount, "Insufficient balance.");
        require(amount >= 0);
        // Modify balance
        Users[msg.sender].balance -= amount;
        Users[receiver].balance += amount;
        return true;
    }
```

The function takes in the parameters receiver address, total amount of gymcoin you want to transfer, which uses to handle the transaction of gymcoin between users.

**Post**

```
  function add_post(string memory context) public {
        User storage user_sender = Users[msg.sender];
        require(user_sender.registered == true, "You have not registered.");
        // require(user_sender.userID == userid, "You must post for yourself");
        Posts.push(Post(user_sender.userID,context, block.timestamp) );
  }
```

The function takes in the parameter context. Using this function, user can share their experience of workout or using gymcoin NFT, which to improve the value of gymcoin to social aspect.

**SignContract**

```
 function signContract(uint contractID) public {
      User storage sender = Users[msg.sender];
      require(sender.registered == true, "You have not registered.");
       require(sender.contractID == 0, "You've already signed a contract. Please cancel
it before you sign a new one.");

      sender.contractID = contractID;

      sender.timeSigned = block.timestamp;
      // check the current balance when signing the contract
      sender.balance_reset = sender.balance;
      uint curr_time = block.timestamp - sender.timeSigned;

      if (sender.contractID == 100) {
          if (curr_time >= 1 seconds && curr_time <= 1 weeks + 1 days) {
              if (sender.balance - sender.balance_reset >= 25){ sender.balance += 5;}
              else { sender.balance -= 3;}
          }
      } if (sender.contractID == 200) {
          if (curr_time >= 1 seconds && curr_time <= 1 weeks + 1 days) {
              if (sender.balance - sender.balance_reset >= 30){ sender.balance += 7;}
              else { sender.balance -= 4;}
          }
      } if (sender.contractID == 300) {
          if (curr_time >= 1 seconds && curr_time <= 1 weeks + 1 days) {
              if (sender.balance - sender.balance_reset >= 35){ sender.balance += 9;}
              else {sender.balance -= 5;}
          }
      }
      sender.balance_reset = sender.balance;
  }
```

The function takes in the parameters contractID. Using this function, user can earn extra gym coin if they follow the contract and reach certain amount of exercise within restricted time. This part used to encourage user to exercise more. And the details of contract selection are introduced on the previous part.

## 6. Tokenomics: GymCoin

**Supply and Earning**: GymCoin has an unlimited supply and is earned through exercise.

**Burning and VE Model**:
We would like to create multiple **NFT collections** with different topics that can be claimed by users with a certain amount of GymCoins and user-levels. The collections would be limited and transferable among users.

In the gaming platform, users can exchange GymCoins to customize their personal **avatar** with things like clothes, accessories, shoes, glasses, bags, etc. We will also include mechanisms to change their physical appearance such as height, muscles, body fat, haircut, facial expressions, etc. Based on their involvement, users can increase their character level and unlock more friend connections and users to play with. Further down the line, we will also implement emotes and other methods of interaction. With these social interactions in place, socialization and communication between GymCoin users is promoted as well as the circulation of GymCoins.

We would also allow staking in our ecosystem, where users lock their GymCoin to attain more voting power on the daily cap or allocation of GymCoins. Higher staking allows stronger voting power, which promotes users to lock their GymCoin longer and to keep participating. Staking would improve the community in the long term.

## 7. Rewards System & Proof of Work

In order to connect to the GymCoin platform, users are required to connect to smart devices and select the corresponding exercise. Using Apple Watches as an example, it will automatically calculate calories burnt through the user's heart rate. This is also our mechanism to make sure users don’t cheat since their heart rate can not be easily imitated by machines. We will determine the exchange rate between calories burnt and GymCoins and apply a Machine Learning clustering algorithm to identify anomalies of data.

Once users exchange GymCoins from calories burnt, they can exchange them for cash through the use of smart-contracts or use them directly in the GymCoin social gaming platform. Also, users are recommended to use MetaMask as their interface to connect to our application website, which allows them to keep track of their behavior and double check their identities at each step with a high level of security.