

Health Passport: a decentralized personal health record platform to deliver trusted health information to the right hands at the right time anywhere in the world

WHITEPAPER



Emrify Inc.
www.emrify.com
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Motivation

Healthcare technology is broken. Whether it's government based universal health coverage in Canada, UK, Germany, or private hospital systems in the US, health information technology currently in operation severely lags behind every single other industry in all facets of hardware and software architecture by at least a decade. Since the inception of the Electronic Medical Records (EMR), personal health information has been in a state of disarray that puts patient's safety, security, and privacy at risk. The Health Insurance Portability and Accountability Act of 1996 (HIPAA) is more than 20 years old with no signs of updates in sight. Meanwhile, hospital and insurance systems are constantly under attacks making headlines news with millions of health records compromised. The latest of which is the largest in history WannaCry ransomware software that locked up thousands of computers in more than 150 countries.[1]

To make matters worse, the vital health data that we pay hospitals and doctors lots of money to collect end up sitting in silos and fragmented across disparate systems. The problem is so bad that even EMRs from the same Electronic Health Record (EHR eg. Epic, Cerner) creator operating within a hospital cannot communicate and interoperate with each other. One major reason behind this was the introduction of the Health Information Technology for Economic and Clinical Health (HITECH) Act in 2009. Under the Act, the US Department of Health and Human Services is spending "as much as \$36.5 billion in spending to create a nationwide network of electronic health records." [2] This started a gold rush where EHR companies pop up overnight to create anything to sell to providers who would implement any EHR they could get at low costs quickly to take advantage of Meaningful Use incentives. Currently, there are roughly 1100 vendors that offer an EHR - twice the number of vendors 4 years ago.[3] This unfettered expansion of health information technology has created one of the worst disaster in the history of information technology for data interoperability.

There is a strong case of double spending in healthcare that will catch fire faster than the case for finance. Duplicate tests such as blood test and MRI scans cost the healthcare industry billions every year. These unnecessary and expensive tests are wasteful, and they put the patient at risk. Prescription fraud also faces a similar problem. The US is currently entrenched in the worst opioid epidemic in history. Without a unified record, addicts have found a loophole to exploit the system by crossing state lines and country borders to get more doctors to prescribe.

Today, we are witnessing a revolution in personal health record: the rise of personal generated health data with the person at the center. Within the next five to ten years, healthcare will be going through a major transformation that is led by the consumer. Disruption is coming to healthcare one way or another. The future clinic is at the home and in the hands of the patient. Combined with new care delivery services such as remote monitoring, telemedicine, doctor-on-

demand, and population health, a new platform must be created to coordinate health information exchange in an open, fluid, and secure manner anywhere in the world.

Blockchain represents a pivotal moment to fix healthcare once and for all. The unique properties of the Ethereum network allows for the first time ever for data to be owned and controlled by an individual. On one hand, the consensus algorithm enables the decentralized mechanism of the ledger to distribute power back to the people. On the other hand, the best cryptography computer science has to offer can be used to secure an identity to protect privacy and security.

Perhaps the time has finally come, the healthcare industry is jumping into blockchain with a level of interest unseen before. The stage is set for startups to offer new value propositions and disrupt the status quo. Whether it's private or public blockchain, top executives are willing to listen for decentralized solutions to solve their pain points. The US healthcare industry is maxed out at 20% GDP. Everyone is working harder without more revenue. As the industry transitions into value based care, stakeholders have come to realize that improving continuity of care will cut costs while remaining relevant and competitive in the marketplace. This is the only way forward that will set a new path towards profit maximization with precision medicine and beyond.

Regulations are on our side. Beginning in 2018, Meaningful Use Stage 3 becomes mandatory for all participants. One of the requirements includes increasing health information exchange to improve care coordination. This is the most promising sign yet from the federal government that could be a critical period for real changes.

Decentralization offers the most promising path to mediate health information exchange between systems across the world. Anyone can start aggregating health data and instantly share it to any party with an identity using the digital token. The importance of trust and integrity of health data cannot be understated. Sensitive health information that could save your life is at stake. The data trails and bread crumbs can now be locked in a universal trusted database.

Ultimately, healthcare is an information science challenge where evidence is based on big data and machine learning algorithms to cure diseases, prevent illnesses, and improve outcomes. This will only truly exist with the collaboration of the 7.5 billion plus people in the world. There's much we don't know. The answer lies in all of us. As we become more connected within the larger context of globalization, Emrify presents its vision for a new platform powered by the people and for the people. Join the revolution and be the CEO of your health. The time is now to fulfill the promise of the fantastic future of medicine.

¹ <http://www.npr.org/sections/thetwo-way/2017/05/15/528451534/wannacry-ransomware-what-we-know-Monday>

² <http://www.washingtonpost.com/wp-dyn/content/article/2009/05/15/AR2009051503667.html>

³ <http://www.practicefusion.com/brown-wilson-black-book-rankings/>

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1. Emrify's Vision

Emrify has been innovating in the healthcare industry with the Personal Health Record (PHR), Drug Facts, and Clinical Trials mobile application with thousands of downloads and thousands of users on the platform. Emrify has also been busy pushing the boundaries at health hackathons with multiple wins to showcase new solutions. Emrify embraces emerging technology while maintaining a grounded deep understanding of the challenges at hand.

As a company, Emrify is constantly searching for the cracks in the healthcare industry to solve the Holy Grail of problems of Interoperability. Emrify truly believes that blockchain is the mighty sword to slay the giant. The decentralized model has come to be the focal point for every stakeholder in the entire continuum of health services. More importantly, it has energized the people to demand more from their health providers. The following subsections will outline Emrify's plan for launching an entirely new health record platform using the HIT token to build the ecosystem.

New HIT digital currency

The first step is to create a new cryptocurrency: Health Information Transfer or Health Information Token (HIT). The token is a utility token that will foster an economy around health data. Health information has strong network effects as more value is gained with more data for analysis. Emrify will establish the fundamental value of HIT for every health stakeholder and the consumers to participate and contribute to the ecosystem from day one.

Building an ecosystem

With the explosion of wearables and increasingly affordable genome sequencing, health data has gained the attention of every health stakeholder including providers, insurance, employers, researchers, government, and pharmaceuticals. In the past years, companies like IMS Health has been getting rich off your medical data by running matching algorithm to sell to big pharmaceuticals.[4] Currently, major players like IBM Watson and Google Verily project Baseline are prime examples of the rising value of big health data.[5] According to a recent survey, both clinicians and executives agree that patient generated data will be more useful than claims data in the next five years.[6] Last year, one of the winning paper submitted to the ONC

⁴ <http://fortune.com/2016/02/09/ims-health-privacy-medical-data/>

⁵ <https://www.technologyreview.com/s/604224/googles-massive-health-study-seeks-10000-volunteers-to-give-up-their-medical-secrets/>

⁶ <https://www.healthcare-informatics.com/news-item/analytics/survey-five-years-genomic-patient-generated-data-will-be-more-useful-claims-data>

"Use of Blockchain in Health IT and Health-Related Research" Ideation Challenge highlights the significance of Patient- Reported Outcome Measures (PROM) over the last few years and discusses the issue of provenance in the transfer of data related to quality of life, treatment adherence, and overall satisfaction [7]. The bottom line is that your health data are being collected and used whether you like it or not. This trend will continue to grow as everyone pushes for more access to higher quality data directly from more people who generate them.

For the consumers, there is a breakdown of trust in health systems to protect their data as they want to free the data and gain more control. After the Ransomware attack, 68% of consumers said they would consider leaving their healthcare provider.[8] This has created an opportunity for personal health record to help consumers aggregate and manage their data. In fact, researchers have forecasted that 75% of adults will use a PHR by 2020.[9]

In addition to security and privacy, personal health record has the potential to improve health outcomes. Here is a noteworthy example of a man using his own medical records to push doctors to remove a cancerous brain tumor the size of a tennis ball.[10] Here is a TED talk about the rise of the citizen scientists to push researchers to do the right thing.[11]

The timing has never been better for a PHR platform to connect all sides to come together to bring healthcare towards the future. Emrify will use economic incentives to get everyone in one place to create and grow the ecosystem from day one. For stakeholders, Emrify will provide a trusted place to collect health data straight from the source of the consumer. This can alleviate big problems such as the \$80 billion annual cost of insurance fraud by enhancing claims verifications. For the consumers, Emrify will empower them with tools to lock up their own data and the freedom to share and sell it on their own terms. Groups such as the quantified-self movement and biohackers will have more data to experiment with than ever before. As more people join, the network effect of Emrify Platform will grow to increase the value of the HIT currency and encourage more stakeholders and users to join.

⁷ "The Use of a Blockchain to Foster the Development of Patient-Reported Outcome Measures". *Jason C. Goldwater, MA, MPA - 2016*

⁸ <https://www.healthcare-informatics.com/news-item/cybersecurity/survey-many-consumers-would-consider-leaving-healthcare-provider-after>

⁹ <https://www.healthcare-informatics.com/news-item/study-75-adults-will-use-personal-health-records-2020-even-without-mu-incentives>

¹⁰ <https://www.nytimes.com/2015/04/01/technology/the-healing-power-of-your-own-medical-data.html>

¹¹ https://www.ted.com/talks/sharon_terry_science_didn_t_understand_my_kids_rare_disease_until_i_decided_to_study_it

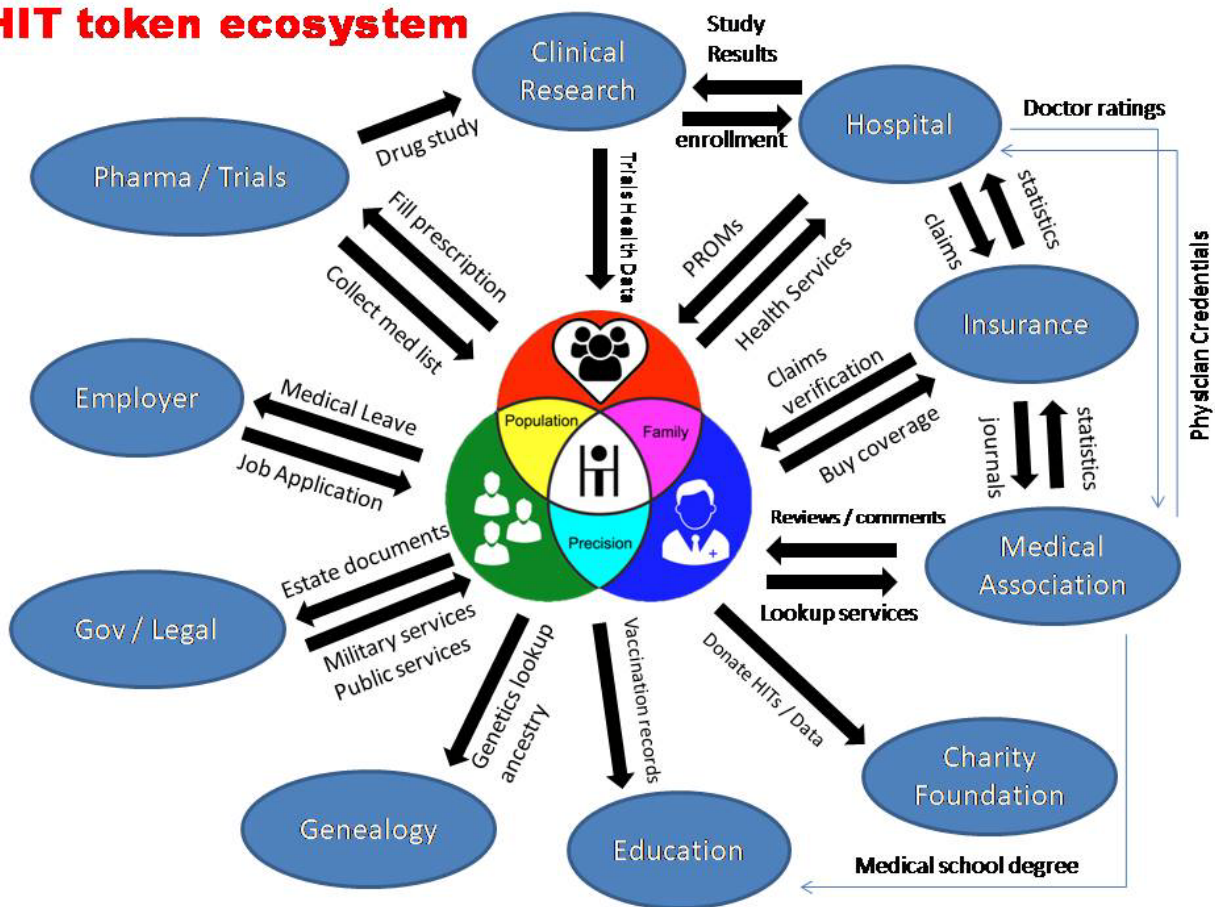
2. The HIT cryptocurrency

Purpose

Emrify is introducing an open source cryptographic token called HIT. HIT will be the unit for all transactions within the ecosystem. HIT will serve as the basis of interoperability with other digital cryptocurrencies. Similarly, units of HIT are fungible and transferable with the ability to trade on cryptocurrency exchange.

HIT is a utility token valuable to both consumers and stakeholders for use in everyday services. For health data buyers, HIT represents the cost to pay network fees and pay users for their data. For consumers, HIT has value for paying transaction fees to share data to transfer and access medical records when needed such as for school vaccinations, for work purposes, for legal matters, for personal uses, for family related health records, and for third-party dapps.

HIT token ecosystem



Health Miners

For the first time ever, consumers can contribute health data for rewards and payments on the network just like Bitcoin miners. Users will never have to pay fees to aggregate data from all sources for storage on the network. Users will have the power to set their own prices and compare market rates. On the flip side, anyone can be a health buyer. As a marketplace, buyers will have the option to set prices and bounties for certain data types and health conditions. At first, wearables data from Fitbit, smart scales, blood pressure, sleep trackers, glucose meter, and other devices will be synced by the users for sale. The reason is that these sources can be validated through API services. As more health companies and providers are validated overtime, more data such as lab results, scans, prescriptions, and complete medical records can be up for sale by the user. Collectively, health miners can shift the focus of healthcare to revolve around the individual by offering the industry the highest quality health data available.

Ethereum and ERC20

HIT will be implemented on the public Ethereum blockchain as an ERC20 token.[12] The Ethereum blockchain is currently the industry standard for issuing custom digital assets and smart contracts. The ERC20 token interface allows for the deployment of a standard token that is compatible with the existing infrastructure of the Ethereum ecosystem, such as development tools, wallets, and exchanges. Ethereum's ability to deploy Turing-complete trustless smart contracts enables complex issuance rules for cryptocurrencies, digital financial contracts, and automated incentive structures. These advanced features and active ecosystem make Ethereum a natural fit for HIT.

¹² ERC20 is the Ethereum token standard. <https://github.com/ethereum/EIPs/issues/20>

3. Building the platform

Emrify personal health record

Emrify Personal Health Record is one of the most popular mobile apps ranking #4 in top apps according to AppAnnie.[13] Currently, the app is available for both iOS and Android with thousands of registered users and hundreds of downloads every month. For the past two years, users have enjoyed using the app based on the reviews. Here’s what people are saying about it.

Device: iPhone
 Country: United States
 Date: Jun 13, 2017

Top Apps for **personal health record**

Export CSV, XLSX

#	App	674 Results	Star Rating
1	Healthspek - Personal Health... Healthspek, LLC		★★★★☆ 4.0
2	Capzule PHR - Your Personal ... Webahn		★★★★☆ 4.0
3	OpenTreatment Personal Hea... OpenTreatment, LLC		N/A
4	Emrify - Personal Health Reco... Emrify Inc.		★★★★☆ 4.5
5	Axilla PHR - Personal Health ... CodeMonkee d.o.o.		N/A
6	Medelinked - Personal Health... Medelinked		N/A
7	Ma Mémoire Médicale – Your... MV SANTE		N/A
8	Health Tracker & Manager for... XLabz		★★★★☆ 4.0
9	drchrono Patient Portal - onp... drchrono Inc		★★★★☆ 3.5
10	FollowMyHealth® Allscripts		★★★★☆ 4.5

Rating	Reviews
★★★★★ 5.0	Retired by Margo3252 New to site. So far so good.
★★★★★ 5.0	Mrs smowwolf06 by Snowwolf06 Just downloaded so still learning the app
★★★★☆ 4.0	mrs by cookiemutch This is a great app, I am able to have all the information at the touch of a finger. I am able to go to a Dr's appointment and go through all things that needs to be discussed including meds without for getting something, the customer support are awesome, always there to help with quick service and always there to lend a hand. I encourage anyone that has alot going on to get this app it does wonders :)
★★★★★ 5.0	Apple needs to Feature this App by ImSchmacked Great job team.
★★★★★ 5.0	Finally an all in one healthcare app by DSkyline Finally an all in one healthcare app with potential!
★★★★★ 5.0	Great app by Bdc63 Easy to use and very helpful
★★★★★ 5.0	Patients have power in one EHR by AF615 I struggle to track down my medical history between doctors in 3 different cities where I've lived. Now I can aggregate all that information in one secure place... and right on my smartphone. Great first release and looking forward to more updates and cool features.
★★★★★ 5.0	Easy to use by SlickGeek Simple to use than other ones.
★★★★★ 5.0	Great job to Emrify by S. Steve Samudrala MD Happy we finally have an option to be the 'Mint' of Our Healthcare Records ;)
★★★★★ 5.0	Excellent personal health tracker/aggregator by Stoves Finally a quality app that allows me to keep all of my personal health info in one place. Great feature set for a first release. Looking forward to even more features in the future!

¹³ As of 6/14/17 – App Annie Keyword Results

What makes Emrify PHR app powerful and different from the others is the web portal that enables the user to share their health data with anyone they choose by using a regenerative access code.[14] With these two tools, Emrify has successfully laid the foundation to allow health data to flow across any boundaries.

Emrify is uniquely positioned in the marketplace as a PHR to lead the industry towards a new blockchain based system. The size of the user base and the ongoing visibility in the app store gives Emrify a unique competitive advantage in onboarding users to blockchain.

Health Passport

With the introduction of blockchain, Emrify will rebrand the PHR as the Health Passport to demonstrate a truly interoperable personal health record that's an international portal to aggregate lifelong health information and put them in the right hands at the right time. At first, the Health Passport will be accessible as a mobile responsive webapp to allow quick iterations and flexible experimentations. As Ethereum improves and more tools become available, the Health Passport will be the first native iOS/Android PHR app available worldwide.

Health Registry

In order to identify the healthcare identity in the ecosystem, a registry must be in place to validate actors making transactions on the network. Although users are free to share data with any anonymous recipients, Emrify will provide validations to attest that certain health stakeholders and health professionals are trusted party. This will create a safer community for health information exchange. Emrify will work with government and private organizations such as the American Medical Association to validate identity. Overtime, the Emrify Registry can be the main directory for all health decentralized applications moving forward.

Health Portal

Emrify will introduce a new blockchain health portal for stakeholders to access shared data at the new dedicated domain name.[15] Through this interface, hospitals and other parties can spend HITs to transact with users who want to sell their data. This is where the ecosystem will come to life to connect everyone who wants to be involved with health data. This will also be a great opportunity to reinvent and modernize health User Interface to the 21st century of fluid and dynamic designs. This will become a constant battleground to set the standards for health data structure and visualizations. Everyone from doctors to nurses to patients are fed up with the cluttered and fatigue inducing legacy health UI that are affecting health outcomes and putting lives at risks. The Health Portal represents a golden opportunity for Emrify to make a bold statement and lead the way.

¹⁴ Web Portal - <https://chart.emrify.com>

¹⁵ New Web Portal - <https://www.chartone.io> (not live)

Health dApp Store

In order to expedite the new age of health designs, Emrify will open the platform up to third party developers to create decentralized products and services including themes, apps, widgets, virtual reality, augmented reality, bots, and voice interfaces such as Alexa Skill and Google Assistant. While doing so echoes the community strength of blockchain, it is also a smart choice that other companies such as Apple have shown to be wildly successful and profitable. Apple offers a handful of stock apps such as phone, mail, calendar, and camera while inviting developers of all kinds to contribute their ideas. Along the same line, Emrify will kickstart the ecosystem with some default dapps such as medications, appointments, directory, labs, and images. Once the initial traction is successful, outside developers and startups are welcome to build more dapps to attract users with flexible monetization models to earn HITs. By being open to innovations, Emrify can continue to be the preferred platform for health information collection to remain at the forefront of the competitions.

PillSync

It has been said that medication record is the tip of the sword for healthcare disruption. While the scope of information is simple, the problem today is that each EHR stores only a snapshot of the patient's history. This is a model use case for blockchain. As the MedRec team has pointed out, "But with blockchain, each prescription is like a deposit, and when doctor discontinues a medication, they take a withdrawal. Looking at a blockchain, a doctor wouldn't have to comb through all the deposits and withdrawals—they would just see the balance."^[16]






With PillSync, Emrify has access to one of the most comprehensive drug databases powered by the US National Library of Medicine. For the past five years, the Drug Facts app has attracted thousands of both consumers and healthcare professionals to lookup drug information. The most popular feature is the ability to upload a pill photo to be identified. To date, PillSync has identified and indexed 1300+ pills to accumulate one of the largest pill image databases on the web.

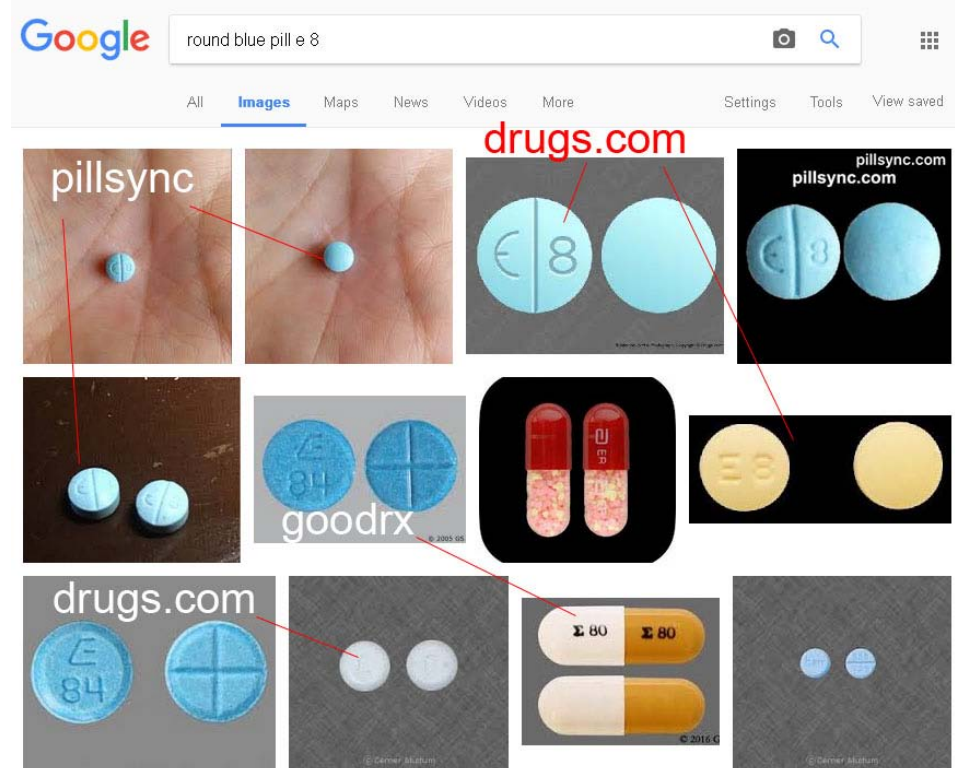
¹⁶ <https://www.wired.com/2017/02/moving-patient-data-messy-blockchain-help/>

For one of the most search terms “pill identifier”, the app is ranked 3rd right next to Drugs.com.[17] For Google Images, most common pills search will show PillSync’s results rivaling the largest players such as Drugs.com, WebMD, and GoodRx.[18]

iPhone United States

Top Apps for **pill identifier**

#	App	292 Results
1	 Pill Identification visions	
2	 Pill Identifier by Drugs.com Drugs	
3	 Pill Sync Drug Facts Interactions Identifier Scanidme Inc	
4	 iPharmacy - Drug Guide & Pill Identifier SigmaPhone LLC	
5	 Pill Identifier and Drug List Mobixed LLC	



In addition, PillSync has recently launched the Drug Barcode Scanner Pro app with the largest drug barcodes lookup system using a user friendly snapchat interface to expand the user base.[19] This is a unique app with the latest computer vision technology to demonstrate the ongoing commitment to innovations. PillSync is also available on Alexa with the skill named “Drug Facts” with projects in the pipeline for Facebook Bots and Google Home assistant.

With strong market penetration in major platforms and commanding web presence, PillSync represents a key crucial resource that will strategically drive users to Emrify to ensure a steady growth path. At the same time, Emrify will have access to the intellectual property of PillSync with the powerful drug database and identification system to create the best medication module as one of the default dapps to jumpstart the ecosystem.

¹⁷ As of 6/14/17 – App Annie Keyword Results

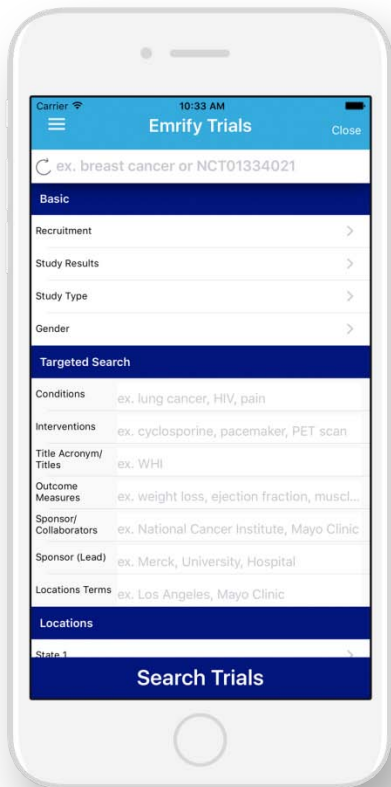
¹⁸ As of 6/14/17 – <https://www.google.com/search?q=round+blue+pill+e+8&source=lnms&tbm=isch>

¹⁹ <http://www.pillsync.com/scanner>

Clinical Trials

The clinical trials industry is ripe for disruption. Here are some shocking numbers:

- 85% of clinical trials finish late due to difficulties enrolling participants [20]
- Nearly one-third of trials never begin after failing to recruit a single participant [20]
- Only 3% of cancer patients participate in trials, with 80% not even aware of their clinical trial options [21]



All of these challenges lead to a drug development process that takes 10-15 years.[22] This industry represents the path of least resistance for health data to flow naturally. Global industry reports forecast revenue of \$22 billion by 2021 with 7.5% compound annual growth rate.[23] This is a key target market for the growth of Health Passport.

Currently, Emrify Trials app puts the power of ClinicalTrials.gov search in your hands.[24] The app enables both consumers and clinicians to be informed of new studies. In doing so, this establishes a firm foundation as Emrify offers more functionalities to secure partnerships. For example, one of the first use cases is to register and collect consent from participants together with the study on the blockchain. This could prevent “hidden outcome switching”, which is the practice of secretly changing the focus of a clinical trial to fit the results. A study last year of 137 trials found 60 reported on outcomes they were not looking for, according to their original protocol.” [25] This is a major pain point that will drive much of the early traction for the ecosystem.

²⁰ <https://www.foundationforpn.org/research/clinical-trials/>

²¹ <http://www.forbes.com/sites/judystone/2015/01/06/how-can-we-encourage-participation-in-clinical-trials/#14e3d9376dd5>

²² <http://www.cancerresearchuk.org/about-cancer/cancers-in-general/cancer-questions/how-long-does-it-take-for-a-new-drug-to-go-through-clinical-trials>

²³ <https://www.mordorintelligence.com/industry-reports/global-clinical-trials-market-growth-trends-and-forecasts-industry>

²⁴ <http://www.emrify.com/trials>

²⁵ <http://www.economist.com/news/science-and-technology/21699099-blockchain-technology-could-improve-reliability-medical-trials-better>

4. Emrify Labs

Overview

The Emrify Platform is an ecosystem of consumers and stakeholders using the HIT cryptocurrency to exchange health data. The purpose and mission of Emrify Labs is to promote and support research, development, and education to accelerate the decentralized protocols for health. In order to fulfill its mission, Emrify Labs will dedicate resources to three specific goals related to development, outreach, and research as follows:

Development goals

The Labs will fund the development of tools to create and maintain a sustainable ecosystem for all parties to create value for one another. The Labs will be fully transparent by supporting open source projects that can be improved by the community. All comments from participants will be heard and considered in the development process.

Outreach goals

The Labs will dedicate resources to fund educational and marketing campaigns to increase the healthcare industry adoption of blockchain. While most resources will be used for products development, outreach is a mandatory step to propagate disruptions on a global scale.

Research goals

The Labs will invest heavily in research by working with developers to create new dapps and test new ways to advance health informatics. The age of big data and AI can move at a swift pace. Only by staying true to a culture of moving fast and breaking things can we hope to take healthcare to the next level. There's a lot of catching up to do.

Location, location, location

Emrify Labs is strategically located in Nashville, Tennessee. This fast growing city is home to hundreds of healthcare companies including the 15 major publicly traded companies that are based here. Three of the five largest investor-owned hospital operators, Community Health System (CHS), Hospital Corporation of America (HCA), and Lifepoint Health, together control more than one-third of the investor-owned hospitals across the country.[26]

²⁶ <http://www.tennessean.com/story/money/industries/health-care/2015/08/18/how-big-health-cares-economic-impact-nashville-388b/31564125/>

Along with Ascension Health and Vanderbilt University Medical Center, the leaders have banded together to form the Center for Medical Interoperability.[27] This new initiative is a powerhouse for changing healthcare with major purchasing power to influence changes from the inside. Emrify Labs has been invited to collaborate closely with the center to use the Health Passport as the gateway to solve interoperability between the major health systems. This puts Emrify in a unique position at the epicenter and ground zero to disrupt healthcare.

Awards

Emrify Labs is proud to be the home of pioneers who push the limits of innovations for health. Here are some relevant accomplishments to showcase our passion and commitment:

Patient Generated Health Data Proposal – ONC* Data Provenance

June 2017 – Finalist

Using the Public Blockchain: Data Provenance for Patient Generated Health Data for more use in Healthcare

- <https://www.cccinnovationcenter.com/challenges/provenance-challenge/>

Health Passport – GE Health Cloud Innovation Challenge

May 2017 – Honorable Mention

Health Passport as Clinical Applications that helps healthcare providers improve clinical outcomes to positively impact care throughout the patient journey

- <https://devpost.com/software/emrify-health-passport>

Emrify Health Recorder – Choosing Care Challenge

April 2017 – Honorable Mention

Emrify Health Recorder leverages the latest in Voice and Vision AI technology to lower the barriers to health literacy and increase access to improve outcomes

- <http://thehealthcareblog.com/blog/2017/04/24/finding-care-can-be-easy-check-out-the-rwjf-choosing-care-challenge-finalists/>

Health Passport – ONC* Blockchain Code-A-Thon

Mar 2017 – 1st place

Health Passport as Data Aggregation and Sharing for Health using blockchain

- <https://digitalchamber.org/events/dc-summit-2017.html>

Blockchain Hackathon – Distributed: Market

Feb 2017 – 1st place

DeadMansBlock is a decentralized fail-safe trigger that releases digital wills to beneficiaries after you die.

- <https://bitcoinmagazine.com/articles/hackathon-winner-can-help-pass-your-bitcoins-after-you-die/>

* Office of the National Coordinator for Health Information Technology who are the main federal agency leading health IT efforts for the entire US health system. <https://www.healthit.gov/newsroom/about-onc>

²⁷ <http://medicalinteroperability.org>

Interoperability

Interoperability among health systems represents the single biggest barrier to a better more efficient healthcare that “could save taxpayers more than \$30 billion a year on wasteful spending”.^[28] There’s no evidence-based medicine without the complete single source of evidence. In order to fix it, there are two distinct phases that must be overcome over a gradual extended period of time.

The first phase is to create a trusted network and standards for Health Information Exchange. Each time data is synced, there is an opportunity to facilitate interoperability. To date, pockets of consortium and private networks have been created to mediate exchanges using outdated protocols. Blockchain is a superior method that is uniquely designed to facilitate a highly trusted and secured exchange. Indeed, there are discussions among these existing networks to adopt a private blockchain for their members. While this is a step in the right direction, it cannot be accepted for exchange within the larger context of the world. Emrify must exist at the center as the independent public blockchain with the highest decentralized network to connect these disparate private chains and enhance trust and protect data provenance.

The second phase is the adoption of a universal standard for the structures and formats of the data for use once it has been transferred. If the data cannot be integrated directly into the recipient’s EHR system, interoperability cannot truly be achieved. The productivity of employees and health staff can be hindered if time is spent on navigating multiple interfaces to aggregate data from different sources. Currently, healthcare lacks data standards in three areas: clinical, personal wearables, and research. Clinical data is the furthest along with the establishment of Fast Healthcare Interoperability Resources (FHIR). Emrify will support FHIR and advance its adoption. At the same time, Emrify will work with stakeholders to set and implement standards for patient generated data such as wearables and introduce common standards for research results to be collected and shared.

Long term goals

In order for Emrify Labs to carry out its mission and solve interoperability to fix healthcare for good, a long term commitment must be established. If Emrify wants to be the leading light for healthcare, it must follow the footsteps of Facebook and Google to fully take advantage of network effects to grow its ecosystem. This is why the support from users around the world is key to the existence and survival of the platform. As the custodian of the token reserve, Emrify Labs will control the supply allocation to accomplish this mission. Methods will be used to prevent buyouts from large health systems and big pharmaceuticals to overtake the platform. Rest assured, Emrify Labs will always remain loyal to the people at all costs. There will be tough decisions ahead and we are stronger if we stick together.

²⁸ <http://www.healthcareitnews.com/news/system-interoperability-provides-massive-benefits>

5. Technical Considerations

This section discusses the general technical considerations as Emrify builds out the platform on the public Ethereum network.

HIPAA compliance

Before going into details, it is important to remember that HIPAA is an old law that does not offer the best practices today. Systems are not safe under these outdated requirements. Since the Health Passport is an independent PHR on behalf of the user, it is not required to be HIPAA compliant. For more details, this document by HHS has clearly defined the health app use scenarios that are exempt.[29] Emrify will be using the latest and safest protocols without being held back by compliance headaches. This is a key position to allow Emrify the flexibility to innovate as fast as other industries. Once data is transferred, it is up to the recipient to be compliant if it is considered a covered entity.

Platform limitations

The Ethereum network currently operates on a Proof of Work blockchain and is therefore limited in bandwidth. Future versions of Ethereum based on Proof of Stake will work toward enhanced throughput and scalability. The current average block confirmation time is approximately 17 seconds. For technical reasons, the block time will marginally increase but will nevertheless be smaller than 30 seconds before August, 2017.[30]

Although health data transactions are low in frequency, the Ethereum transaction confirmation times can result in significant delays that can affect usability. Given these barriers, Emrify will initially implement a semi-centralized hybrid with on-chain and off-chain services for better user experience and scalable interactions. At the core, transactions will be settled on the Ethereum public blockchain. However, Emrify will develop cloud servers to temporarily store and cache data to improve latency and avoid unnecessary network fees.

Another core pending milestone is the abstraction features with the anticipated release of Metropolis. This update will offer Zksnarks to obfuscate the transaction details and allow Emrify to pay for gas on behalf of the users. Currently, it is not realistic to have users worry about gas for a production product. Everything must be seamless and easy to use. All transactions, exchanges, and fees will be calculated in units of HITs.

²⁹ <https://hipaaqsportal.hhs.gov/community-library/accounts/92/925889/OCR-health-app-developer-scenarios-2-2016.pdf>

³⁰ <https://www.ethnews.com/vitalik-buterin-on-ether-price-affecting-the-metropolis-update>

Identity

Within the decentralized application, a new method for user identity is required to interact with the ecosystem. This becomes an important issue to establish a consistent identity across services and third-party dapps. Currently, many users are introduced to decentralized services through wallets for storing cryptocurrencies such as Bitcoin. Emrify Labs will try to support as many third-party identity and wallet services as possible to keep the onboarding process simple. One promising project that Emrify strongly supports is the user friendly self-sovereign identity uPort. They are removing a lot of the friction for new users to manage identity and blur the lines between a regular application and a dapp. Another interesting identity service is Civic to secure and protect user identity that can be validated. Emrify Labs will be collaborating with the teams to help advance mainstream adoption of blockchain.

Encryption

Data encryption becomes an important issue when health data is placed on the public Ethereum network. There are a few methods that can be used to achieve encryption with blockchain. The simplest way is to create one master symmetric key that Emrify can use to encrypt the data before hashing the file for storage. Upon retrieval of the file, the same key can then be used to decrypt the file for display and download after permissions are validated. Since Emrify is the sole custodian of the key, the process is easy to implement and can be done today. However, this means that all access must go through Emrify for decryption. Ideally, this does not fit with our ethos for a truly decentralized ecosystem. The better and more complex method requires a Public Key Infrastructure where the sender can encrypt the file with the recipient's public address so that only the recipient can decrypt it with their private key. Since only the selected recipient can decrypt the file, permission is natively integrated into the keys management layer. Given this limitation, Emrify will slowly transition encryption methodology as the ecosystem gains maturity. This is only a matter of time.

Prototype

In order to jumpstart the ecosystem, Emrify has launched the live beta of Health Passport to incentivize early users of the network. You can sign up at www.HealthPassport.me to start earning HITs today. Simply create a profile and add some Fitbit data to collect HITs that will appreciate in value as more people join. This is our testament to show investors that we are serious about building products to ensure the success of the platform. As we ramp up towards the token sale, our goal is to have more tangible solutions and traction to convey confidence in the team and solidify our vision to investors, users, and stakeholders.

www.emrify.com/help

6. HIT token issuance

HIT token allocation

In order to finance the HIT roadmap towards disruption, Emrify will conduct a token generation event to distribute **1 billion units** of HITs. **40%** of 1 billion (400 million) HITs will be available for the crowdsale. Each HIT will be priced at **0.025 cents per HIT** to raise a total of **\$10 million**. At the conclusion of the sale, the distributed HITs will constitute the entirety of the available liquid supply. The divisions of HITs are:

20% of 1 billion (200 million) HITs will be preallocated to the founding members of Emrify Labs, advisors, core team, and early employees all subjected to a long-term vesting schedule. In return, Emrify will deploy resources to integrate the HIT cryptocurrency and go to market

30% of 1 billion (300 million) HITs will be under the oversight of Emrify Labs and to be used strategically to grow the ecosystem to reward early users and strategic partners to participate in the network including health stakeholders, dapps, and third party developers

10% of 1 billion (100 million) HITs will be reserved for the foundation to have resources for development and attract employees for growth. The unused HITs will be attached to the above 30% to fuel adoption as this is the most important goal

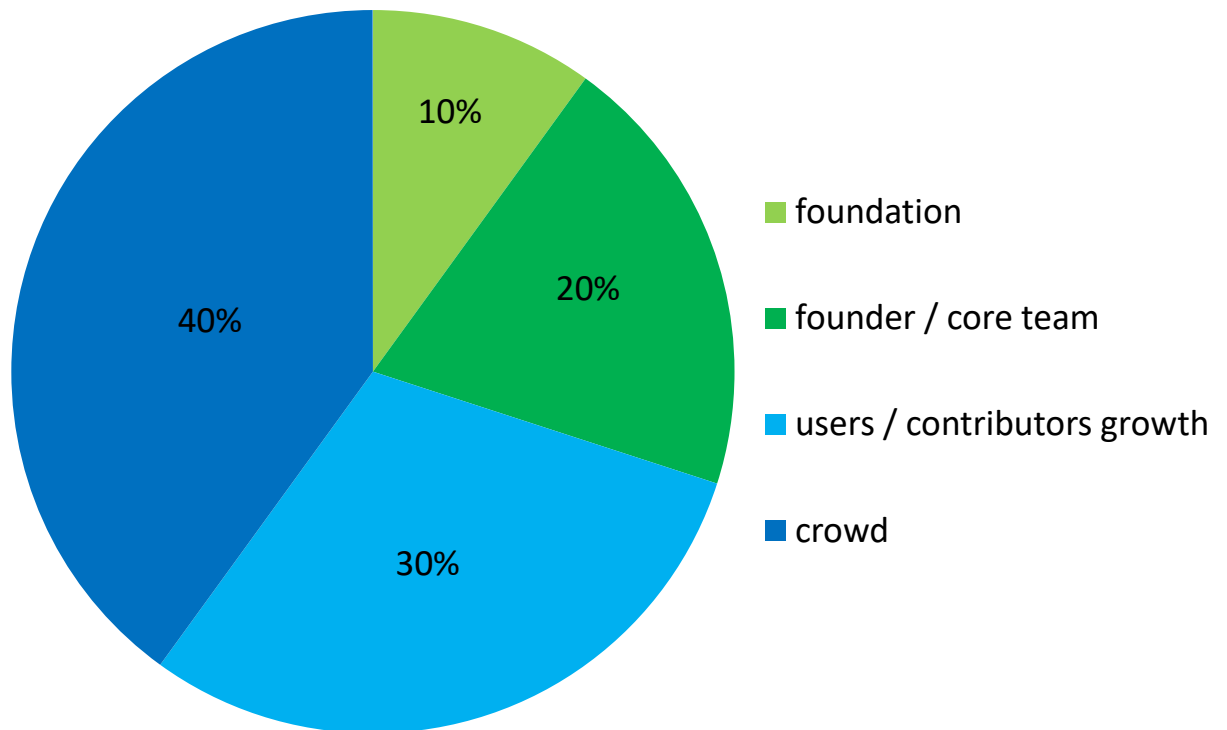
Utility Token

At Emrify, we believe the tokenization of health information is a golden opportunity to stake the blockchain network to disrupt healthcare.[31] We strongly believe that a Health Utility Token is an innovative mechanism that truly deserves to be carefully examined under the law. Given the circumstances, the US state of Wyoming has passed laws that provide flexibility for the utility token to be developed further. Although there are still uncertainty under federal guidelines, Wyoming gives genuine blockchain startups a starting point to begin the conversation as we all explore the promise of this new technology. We have built prototypes to demonstrate how HITs are used to exchange health information. Our goal is to have HITs transfer working in production as soon as possible. We look forward to working with the State of Wyoming and the SEC to earn their trust to continue pushing blockchain forward to change healthcare.

³¹ <https://medium.com/@mrtomnguyen/emrify-hit-tokenization-of-health-information-the-seed-for-health-disruptions-b63f3ff42683>

Supply Schedule

Token Distribution - 1 billion HITs



Token Generation Event

Emrify Labs will begin the token generation event in Spring 2018. It is beneficial for stakeholders to buy tokens early to stock up on HITs for health data transfer once the network is operational. As a testament to seeding the network, there is a large discount for stakeholders including hospitals, pharmaceuticals, insurance, employers, researchers, academia, government, Google, and anyone else who want access to more health data.

To be notified of updates regarding the event, participants are invited to submit their email address at hit.emrify.com. The pre-registration process will require proof of identity and residence for larger purchases in order to ensure regulatory compliance. Please check the website for further announcements regarding the time and structure of the sale.

7. Founding Team

Core Team



Tom Nguyen

Founder & CEO

Tom Nguyen is the founder and CEO of Emrify Inc. leading the vision for HIT. With a diverse background in Economics, Medicine, and self-taught Programming, Tom has been self funding Emrify to seek innovative solutions to disrupt healthcare to solve his own personal goal of health expectancy exceeding 150 years. Over the past 10 years, Tom has created many consumer facing applications and proven time and time again to execute successful products and innovate with multiple hackathons wins. <https://www.linkedin.com/in/mrtomnguyen/>



James Black

CTO

James holds both Computer Science and Electrical Engineering degrees with extensive healthcare experiences. He is excited by changes in technology as he works toward helping to create a better future; blending very strong technical background with an understanding of business. James is most comfortable at the intersection of mobile, with AR/VR/ML with blockchain and reactive architecture that will change industries. <https://www.linkedin.com/in/jamesblackjr/>



Vikas Singh

VP Engineering

Vikas Singh is an experienced developer who is a true guardian of blockchain. Vikas has a proven track record of product development and blockchain development at a health company in India. Vikas is an active member in the community to test out new tools and educate others on the new world of blockchain. Vikas is passionate about disrupting healthcare with blockchain. <https://www.linkedin.com/in/vikas-singh-8299a315/>



Advisors

David Perry

Product Strategy, Consensys

<https://www.linkedin.com/in/davidhperry/>

David Koepsell

Founder & CEO, Encrypgen

<https://www.linkedin.com/in/david-koepsell-8a1aa413a/>

Dr. Thomas Spain, MD

Principal, WhiteCoat Innovations, LLC

<https://www.linkedin.com/in/thomasspainmd/>

Tommy Ragsdale

Director of Strategy, Center for Medical

Interoperability

<https://www.linkedin.com/in/tommyragsdale/>

Bernard Lin

Chief Alchemist Blockchain, OpenCrowd

<https://www.linkedin.com/in/bernardlin/>

Calvin Froedge

Developer, BitShares

<https://www.linkedin.com/in/calvinfr/>

Travis Thayer

Managing Partner, n3xt3 ventures llc

<https://www.linkedin.com/in/travisjthayer/>

Ralf Kubli

Principal, Lakeside Partners

<https://www.linkedin.com/in/ralf-kubli-644393/>