



Dragonsbane

A decentralized anonymous resource for maximum personalization of health and wellness for all

NeuroCog

System v0.1.0

Document v4

Organizational Goal

The Dragonsbane Project seeks to create a decentralized anonymous resource to provide maximum personalization of health and wellness for all individuals using the system. Imagine a healthier world where you are in charge of your own healthcare data. Dragonsbane is not a company seeking to profit from your life; it is a project seeking to increase the profit of your life.

This paper is the specifications defined for implementing the white paper Dragonsbane-WP limited specifically to this product.

A Replacement for Workplace Drug Testing

Why We Test

Not all jobs create a safety risk in the workplace or for the public. While most jobs have only a remote connection to safety (the ability to leave a building safely if its on fire, for instance), some are inherently dangerous. These jobs are called Safety Sensitive Positions and require the moment to moment ability to maintain

safety. These positions require full neurocognitive function of all members of the work force. Individuals who work in healthcare, mass transport operators, heavy construction equipment operators, armed police, and many others have members of the public and their own lives in their hands on a moment to moment basis. The utmost in reaction time, memory, and executive functioning is required in these jobs.

Impairment

When the person in a safety sensitive position cannot do the job because of a lack of neuro-cognitive function they are said to be impaired. Historically, the most common cause of impairment focused on by workplace safety programs is that involving drugs or alcohol.

A Legitimate Government Interest

Workplace drug testing in some settings is regulated and monitored by the US Federal government. The government cites public safety as the legitimate government interest that allows it to mandate samples of body fluids for testing. In cases where the government is not involved, such testing is done by the voluntary consent of the employee as a condition of the job. In such cases consent and testing is a private voluntary contract entered into between employer and employee. Yet many employees say they feel coerced into this testing and feel it is an invasion of privacy and an invasion of their bodies.

Problems with Workplace Drug Testing

- **Doesn't measure all impairments**—Impairment need not be from drugs or alcohol. Missing a night's sleep, for whatever innocent purpose, creates a neuro-cognitive state equal to that of a measurable blood alcohol level. No one has a problem with a doctor operating on them without a good night's sleep, but no one wants a doctor who has been drinking. Impairment can come from many causes such as illness, emotional state, lack of sleep, nutritional deficiency, legitimate medication, and others. In safety sensitive positions, the cause of the impairment does not matter. What matters is the assurance that the operator is not working impaired. This is not assured by periodic (even daily) drug testing.

- **Doesn't measure current impairment**—Testing urine (the most commonly tested body fluid) for drugs tells us what the person has taken, metabolized, and excreted from their kidneys. It does not tell us what is in the person's system currently. A person may have last smoked cannabis five days ago, have no remaining THC in their blood or brain, and have a positive urine for THC.
- **Intrusive with regard to privacy and personal behavior**—This provides an intrusion into the worker's life when he is not on the job. The worker, as a function of the job, is obligated to maintain certain behaviors even when off the job. Even when not in a safety situation, such as vacation, a safety sensitive worker cannot take a substance for fear of it being still in their urine on return to work.
- **Expensive if done well**—Urine testing is done with simple screening technology that must be confirmed by expensive Mass Spectrometry equipment. This limits good testing to random periodic testing which still may not find all the positives. This provides a very wide net to allow safety sensitive workers to work for considerable time, putting lives at risk, without being found to be potentially impaired on the job.
- **Inaccurate if done cheaply**—While not acceptable in federally regulated testing, some have used screens alone to find cases of “substance abuse.” These inexpensive screens are based on immunoassay and are notoriously inaccurate. Everyday items and over the counter medicines commonly cause positives.

No Alternative

So why do we still do workplace drug testing? Because we have to do something, and there is no alternative available. Until now.

New Alternative

Advances in mobile and blockchain technology, as well as advances in understanding the day to day fluctuations in neurocognitive function, present us with a new alternative.

Description of System

The app on a mobile device will provide the testing. The test is purchased using BANE, taken, encrypted, and saved within the mobile device. The mobile device's biometric support ensures that the person who took the test was the same person associated with their public key.

Baseline testing is done initially to ensure that the person's non-impaired scores are present in the mobile device's database and is performed in front of those that the scores will be sent to both verifying a valid baseline. When the person tests, the scores are compared to the baseline and a determination of impairment is made. Before deployment, we will test the device on people with a number of impairments in multiple studies to confirm the device's usefulness.

Why mobile? This solution has been possible for years but hard to deploy. For instance a factory operator with 4 computers and a shift of 20 people will have to run 4 people at a time through the system extending the time from work from 5–8min to 25–40min, an unacceptable loss. With the majority of people having a smartphone, this is no longer an issue. Those that do not have a smartphone will not be able to purchase this application but it is not a requirement to take the tests.

Description of Safeguards

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Usage Scenarios

Integration with centralized systems on a per-account basis gets prohibitively expensive so a simple integration technique is supported by default. The mobile application accepts SMS messages as triggers to start a test and submits results via an SMS message. Another option is to provide no integration treating the tests as logs for later proof of non-impairment. History logs can be submitted later by SMS or Email as a PDF.

There is literally no end to the usage scenarios for this app. Anywhere the question of impairment arises, we can answer that question simply, cheaply, quickly and without invading the privacy of the individual or collecting a bodily fluid against their will. The following are some examples.

Surgeons—With this NeuroCog testing application, surgeons can document their lack of impairment right before an operation. There is already an inherent risk of impaired surgeons operating which is reflected in hospital and physician insurance. There should be an immediate drop in insurance premiums when the system is instituted in excess of what it will cost to deploy the system. On top of that there are the savings to the system for not needing urine drug testing system.

Financially Interested: Hospitals, Insurance Companies

Police—Police are at constant risk of an armed conflict after which there are always questions concerning their state of mind. Body cameras are worn by police to document their actions, but these are turned off during times requiring privacy. It is possible to implement this testing system so that every time a policeman turns on their body camera they take a test. This ensures that they are not impaired when starting the duty that the camera documents.

Financially Interested: Police Departments

Port Workers—large port cranes are multi-million dollar pieces of equipment which interact with ships costing upwards of a hundred million dollars. They are powerful and capable to inflicting much financial damage, not to mention the loss of life a crane accident could cause. These cranes are handled by crews rather than by individual operators and the crews are tested randomly and periodically for drugs of abuse. The testing could be done at the beginning of every shift ensuring that crane operators are not impaired before their start their duties.

Financially Interested: Port Ownership

Patients—Physicians sometimes have to give patients medications that might be impairing. Not only sedatives, but high blood pressure medicine and even allergy medication may make it unsafe to drive. Doctors have been sued by third parties for causing impairment in their patients who caused an accident while using the medication as directed. It's hard to defend this and prove someone is not impaired when they are taking a medication known to cause impairment in some. The answer is to do before and after neurocognitive testing of patients so that the doctor can document that their patients are not impaired. Again, this will eliminate the premium for this risk from the insurance pool.

Financially Interested: Hospitals, Physicians, Insurance

Use Cases

For the features above, the following use cases capture more detailed functionality necessary to implement them. Each includes the components required to implement them and estimated person hours assuming all-around mid-level skills.

Tests

Neuro-cognitive tests are performed by end users. They can be initiated manually (POC/Prototype) and by triggers (GA).

- View Test Disclaimer
- Start Test
- Ongoing: Eye Blinks
 - The camera is watching for eye blinks the entire time. There may also be something we can do with pupil direction if I understand that right.
- Pre-Test: Ma Jong Tiles
 - First task is to prove hardware is working right and the person understands the instructions. To do this we'll do a simple test using ma jong tiles. The person is asked to tap the screen when a tile turns over to show its face, and this act turns it back over. We can do 5 tiles in 30 seconds, not evenly spaced in time. We'd score how many times the person tapped the screen appropriately and how many inappropriate taps there were. This one is so simple that if they don't have a perfect score, something is wrong that the test can't be done (screen broken, person very drunk, person has debilitating dementia, etc).
- Simple Memory Test
 - We can use a series of tiles flipped over one at a time. You only tap on it if it was the one shown just before it. So If I show you 3 wind and the previous tile had been 6 bamboo then you do nothing. If the next time I show you is the 3 wind again then you tap the screen. This tests short term memory and, over the session, the ability to retain working knowledge of the instructions. We can do one every 5 seconds for 1 min.
- Complex Memory Test
 - We can also do a more complex memory like 2 back which requires more attention. If I show you 6 bamboo, and then 3 wind, and then 3

wind you should not tap the screen, but if the last one is 6 bamboo, you should. We could even try 3 back.

- Working Memory Test
 - Have you seen this tile during this session. There's not so much attention here as working memory and also tests for reality testing. Of course the person has seen each tile at some time in their lives so that dream like time quality that comes with sleep deprivation will be tests. We'd show tiles over a period of a minute that were shown and not shown and measure the right and wrong taps from the person.
- Submit Tests
- View Test Results
- View Test History
- Send Test History (as PDF report)

Tokens

BANE tokens are needed to take the tests. They can be purchased with Ether. Users can be assigned for taking tests if tokens are purchased on their behalf. For example, an employer creates an account and purchases BANE tokens. Users create accounts and then the employer assigns their employees to their account. The employee can now use their employer account's BANE to take tests. When BANE gets low in an account, the account owner is notified.

- Mint tokens and place in primary account
- Query the total supply of the token contract (ERC20)
- Issue tokens to external account
- Activate inactive balances for quarter
- Query inactive balance of external account
- Query the balance of an external account (ERC20)
- Approve transfer from an account incrementally
- Approve transfer from an account (ERC20)
- Transfer from a supplied account (ERC20)
- Query the balance of an external account (ERC20)
- Offer tokens for a price in Ether
- View Offers
- Remove offer

- Buy tokens in Ether
- Transfer tokens from sender's external account to another external account (ERC20)
- Approve transfer from an account incrementally
- Notify Account Holder Low BANE Level
- Activate inactive balances for quarter
- Query inactive balance of external account

Identification

Ensure individual taking test is valid. Initial method will be to use facial scans solely. For GA, we will start with an Iris Scan to log into the account followed by requiring a finger continuously over the fingerprint sensor (not sure yet) and then facial scans periodically ensuring the same person is taking the test.

- Capture & Verify Biomarkers
 - Face
 - Fingerprint
 - Iris Scan

Privacy

User's profile information, biomarkers, and test scores are kept confidential by maintaining them within the user's device encrypted. Test scores can be shared with others as desired including with an employer.

- Securing Private Keys
- Private Key Strategy
- Encrypt
- Decrypt
- Sign
- Verify Signature
- Hash
- Verify Integrity

Settings

Configurations of the application.

- Register Profile
- Edit Profile
- View Profile
- Generate Keys
- Load Keys
- Test Score Submission Address
- Notifications (need further defined)
- Language Selection
- Language Translations

Administration

Administer the application.

- Create Account
- Assign User

Domain Models

Entities involved in the application.

- Account
- BANE Token
- User
- Test

Components

Three main components needed, web site for marketing (including a potential ICO page that must be deployed separately), a mobile android application, and an ethereum smart contract written in solidity.

Product Marketing Web Site

The product needs a marketing site to explain the problems it solves, its features, and how to install and use it.

Effort

- Information for potential investors (ICO)
- Information for investors and buyers
- On-line help

Android Mobile Application Core

Mobile application targeting Android as it's open-source and by far the most used OS in mobile phones globally.

- Framework
- Web3j Integration & Configuration
- Anonymity Layer Integration & Configuration
- General App Configuration Support

Ethereum Smart Contracts

Smart contracts to automate token issue/buy/sell. Ethereum chosen as it's the most popular platform and the most mature as of 2017 EOY. Solidity appears to have the most support for Ethereum contracts also.

ERC20 Interface

Ethereum standard token contract interface. This ensures BANE token can be used with other applications if/when desired (including decentralized exchanges).

BANE Token

The utility token used throughout all Dragonsbane applications. The implementing Ethereum contract supports.

Model Definition

Models must be defined for each test.

Scoring

Each test must be scored individually and against a larger population.

Model Validation

Models defined are evaluated against scores to determine if the models need adjusting.

Resources

Initially Howard, Brian, and Dirk are the primary resources to get the POC and prototype built. Gerb is a potential option for Android and Solidity development and Alexander for Solidity development if available and interested to speed up the POC/Prototype and/or Alpha/Bravo/GA release.

Howard Wetsman – Interim CEO / Marketing / Sales / Product Management

Brian Taylor – Chief Architect / Project Lead / Android, Solidity, AI Dev / QA

Gerb Stralko – Android / Solidity / Graph Dev / QA

Dirk Dorony – Data Analysis / Modeling / Integration, DB Dev (SQLite), QA

Alexander Wormbs – Solidity Dev / QA

Roadmap

The product will be built in two primary phases.

The first will consist of two milestones. The first milestone is a Proof-of-Concept (POC) with minimal functionality implementing the greatest risks to ensure the idea is feasible. With the go ahead, the second milestone, the Prototype, will be built which will include all tests to make the application but without security and Ethereum integration. The results of this implementation are expected to raise funds to complete the security and Ethereum integration for a full GA release. This phase has two options (below). A minimum cost and a minimum completion date option. It is being funded by the founder.

The second phase is adding the security and Ethereum integration. It will be accomplished in three milestones: Alpha, Beta, and GA.

Details on the numbers for schedule and cost can be found in Dragonsbane-Neurocog-ProjectPlanning.ods.

Founder Funded

Minimum Monthly Cost POC + Prototype Schedule

This option uses Brian at 40hr/month retainer and includes about \$10k for Dirk to model and verify models. Estimated completion date is June 2019.

- POC: ~ 6 months
- Prototype: ~ 10 months
- **Est. Completion Date = June 2019**
- Est. Completion Cost = \$50k
- **Avg. Monthly Invoice = \$3.1k**

POC - 3rd Quarter 2018

A minimal implementation focused on establishing a very simple test.

Prototype - 2nd Quarter 2019

A fully working example of the overall testing.

Minimum Completion Date POC + Prototype Schedule

This option is about the same cost but paid more up-front (\$7.3k avg. monthly invoice) to get it out sooner. It requires some 40hr/wk work weeks from Brian. Estimated completion date is August 2018.

- POC: ~ 2 months
- Prototype: ~ 4 months
- **Est. Completion Date = August 2018**
- **Est. Completion Cost = \$44k**
- **Avg. Monthly Invoice = \$7.3k**

POC - 1st Quarter 2018

A minimal implementation focused on establishing a very simple test.

Prototype - 2nd Quarter 2018

A fully working example of the overall testing.

Investor Funded

- Raise \$50k
- Alpha: ~ 2 months
- Beta: ~ 2 months
- GA: ~ 1 month
- Est. Completion Date = January 2019 or November 2019
- Est. Completion Cost = \$50k

Version Notes

V4 1/9/2018 – Revamped to support a more R&D Modeling POC & Prototype followed by fundraising for Alpha, Beta, and GA. Includes Minimum Cost and Minimum Time Schedules.

V3 12/24/2017 – Added Identification description and Cost Option 3.

V2 12/23/2017 – Added use cases, components, resources, schedule options, and recommendation.

V1 12/20/2017 – Initial draft with business case.