SmartGive

Final Project Report

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ABSTRACT

SmartGive is a blockchain-based application for in-kind (i.e. non-cash) donations, aimed at connecting individual donors and small local charity organizations around the world. Our mission is to reach transparency and accountability in charitable giving and decrease reliance on blind trust. Following the open philanthropy movement doctrine[1] and even taking it a step further in terms of technology used, SmartGive is designed as a crowdfunded non-profit with its main asset - the online platform - built on Ethereum blockchain, a transparent decentralized ledger. All the transactions made through SmartGive become automatically open to public scrutiny.

A three-party Ethereum smart contract is the core element of the platform and a framework for each donation transaction. As mentioned above, all donations are in-kind, meaning that a recipient receives a requested item, not money. A donor purchases this item utilizing SmartGive's marketplace and bidding system. The smart contract harmonizes and protects the interests of three participants of the platform: an individual donor who wants to see where the donated money goes, a small local charity which needs some control over the items it gets as in-kind donations, and a merchant who is always eager to open new markets.

While the blockchain technology still experiences growth problems and the community around it is a peculiar mix of visionaries and opportunists, we see more and more useful blockchain applications created every year. We designed the SmartGive app to be part of this cohort.

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[1] Open Philanthropy movement sets new standards of openness and transparency, as well as enhances data access and community participation. Lucy Bernholz, Open Philanthropy: A Modest Manifesto, New America foundation/California voices blog, March 15, 2010, http://archive.li/NlP6 Accessed April 24, 2018

THE PROBLEM

Fewer donors donate every year, but those who do - very often wealthy individuals - donate bigger sums. Growing economic inequality contributes to that. But also, the tax deduction rules have their impact because they incentivize wealthy people more than people with low and mid-level income.

According to the IRS, in 2003-13, while itemized charitable deductions from donors making $100,000 or more increased by 40%, itemized charitable deductions from donors making less than $100,000 declined by 34%[2]. Also, the number of individual donors dropped by over 7% in just five years (2011-16), mainly due to the steady decline in new donor acquisition, Target Analytics reports. Donor retention rates, especially first-year, are mostly negative[3].

Funds tend to solicit big donors hoping to get a bigger check. Working with wealthy donors is cheaper in overhead than to go after small donations from a wider range of low/mid income donors. Charity Navigator indirectly promotes this strategy by giving a better rating to the charities that increase the proportion of funds raised to overhead every year.

As a result, bigger donors tend to give money to bigger charities because they can swallow their donations; bigger charities grow, smaller charities face fund cuts. According to the 2016 Fundraising Effectiveness Survey Report[4], organizations raising $500,000 or more grew by a median 10.7%; organizations raising between $100,000 and $500,000 had a median 0.6% growth, and organizations raising less

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[2] Gilded Giving. Top-heavy philanthropy in an age of extreme inequality. http://www.ips-dc.org/wp-content/uploads/2016/11/Gilded-Giving-Final-pdf.pdf, Accessed April 24, 2018

[3] Target Analytics, donorCentrics™ Index of Direct Marketing Fundraising. 2016 Fourth Calendar Quarter Results. https://www.blackbaud.com/files/resources/Target_Index_Results_Summary_Q4_2016.pdf Accessed April 24, 2018

[4] Bill Levis, Ben Miller, and Cathy Williams, 2016 Fundraising Effectiveness Survey Report, Association of Fundraising Professionals, Urban Institute, March 19, 2016.

than $100,000 experienced a median loss of 11.8%.

But having many small active donors is important evidence of healthy social capital[5]. Having many small local charities is also extremely important since they do a great job reaching people in need directly, are more flexible, responsive, and often more efficient than global non-profits. This is because small charities are usually naturally embedded into the communities they represent and have close bonds with locals. They usually have an acute understanding of people's needs and local specifics, are less bureaucratic and "have the ability to react spontaneously to changing circumstances and arising needs."[6]

Moreover, bigger charities quite often serve as just the fundraiser agencies, and they need the smaller ones to present to their donors a good reason to donate. These big charities cut down their operations to donors' outreach, raising funds, and reimbursing everything that wasn't spent on overhead to the smaller funds. These small charities directly help people in need and have their own corresponding overhead. Provided that the charities' overhead is within the industry excellence standard of 15%, up to 30 cents of each dollar donated to a big organization goes to operational expenses. This is a big cut: our survey among potential donors showed that people are more comfortable with overhead at 15-20% than 25% and higher.

Why wouldn't all donors give directly to local charities to avoid double-spending on overhead? For many donors, the difference between a brand name charity and a small local one is the perceived trust. People tend to blindly trust recognizable names.

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[5] However elusive and changing the notion of social capital is, many studies measure it by asking the question: "do you trust the others?" Other researches analyze the participation in voluntary associations or civic activities, to which philanthropy, we think, is central.
[6] Lewis Garland, Why charities should make a big deal of being small. UKFundraising, https://fundraising.co.uk/2015/09/10/why-charities-should-make-a-big-deal-of-being-small/#.Wt99gojwZPa. Accessed April 24, 2018

Hence, our first problem statement:

How might we help small charities so that they receive the necessary donations when they are not recognized or trusted enough to receive donations on their own?

Are the donors always happy when they donate to brand names? The American Red Cross disappointed many of its donors when it failed to be open and straight about money spent to alleviate the Haiti earthquake consequences in 2010. Red Cross raised $488 million and announced the permanent homes construction and community development projects in the disaster zone. Four years later, NPR and ProPublica discovered that the American Red Cross had built only six new homes in Haiti. And even when they eventually were interrogated by Sen. Charles Grassley on that matter, the American Red Cross requested that its testimony not be made public, so their donors still don't know where their money went.

Hence, our second problem statement:

How might we help donors confidently donate their money to people in need so that the risk of donation misuse is small when donors don't have time to conduct thorough research of charity organizations?

We think transparency is the key. Transparency can effectively replace blind trust because it gives to donors exactly what they are seeking when they turn to brand names: a guarantee they will not be deceived.

Our donors' survey showed that knowing how a charity spends your money turned to be important to 70% of respondents. Visibility into how donated money is spent was number one among four factors increasing the donors' willingness to donate. It was presented as even more influential than "recognizing the charitable organization".

THE SOLUTION

SmartGive solves the problems of trust and accountability in charitable giving by creating an immutable record, logging all participants' interactions. Moreover, SmartGive is a platform for charities to articulate specific needs, which donors may then fund. After, merchants begin bidding on the donor's selection, effectively competing over the cost of the item and driving the price to a competitive level. The charity can select their desired merchant, thereby initiating a money transfer. Any money left over can be returned to the donor, or, if he chooses, allocated to another donation. All actions described here represent transactions on the Ethereum blockchain, creating a record of all participants' interactions, auditable by anyone.

First, the charity makes a request on our platform, inputting their information into our centralized database. They indicate what kind of items they need, an estimated cost, and a gift-expiration date. They can also write an explanatory note, convincing potential donors to donate to their cause. This information, which we call a SmartGift or Gift, stays in our centralized database until a donor decides to fulfill their request.

The donor selects a SmartGift to donate to and sets the maximum amount of money he would be willing to donate to fund the Gift. Upon clicking the "Donate" button, he submits the SmartGift to the Ethereum blockchain, creating a permanent record of the SmartGift for anyone to see. More importantly, when he sends this Gift to the blockchain, he creates a smart contract[7] with a distinctive address on the blockchain. Upon "donating" he sends his maximum donation amount to that smart contract's address (his money stays locked up in that smart contract until either the charity selects a merchant or the SmartGift's expiration time has been reached).

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[7] Smart contracts are applications capable of holding digital assets and are controlled by pieces of code containing arbitrary rules. See https://github.com/ethereum/wiki/wiki/White-Paper.

The next step is bidding by merchants. Any approved merchant can bid on the Gift through the SmartGive platform. They can see how much the donor is willing to pay for the Gift and the current lowest bid. They are reminded that only one of the bottom three bids will be selected and are encouraged to bid below the lowest bidder.

The charity selects one of the lowest three bidders to fulfill the Gift. We allow them to pick one of the bottom three, rather than requiring that they accept the lowest because the charity is in the best position to decide how its Gift should be fulfilled and may have a legitimate reason to not always take the lowest bidder. However, limiting the merchant to one of the bottom three mitigates the potential for collusion between the merchant and the charity by lowering the potential benefits; if they are colluding, and there are more than three merchants, the colluding merchant still has to offer a competitive price.

Once the charity selects the merchant, the money is released to him from the smart contract and the merchant sends to the Gift to the charity. When the charity receives it, they sign the SmartGift contract, acknowledging receipt -- effectively contributing to the merchant's and their own reputations.

Why Blockchain?

We integrate the Ethereum blockchain into our platform in order to enable auditability, availability, donor control, a reputation system, and a three-party donation escrow system using smart contracts.

First of all, blockchain allows the transactions to be audited. Integrating blockchain into our application enabled transparency and accountability that would otherwise not have been possible. The transactions are fully auditable because they are logged in the global state of the public Ethereum Virtual Machine, the Ethereum network. Anyone can create a node in the Ethereum network, downloading a copy of the ledger and validating transactions sent to the

network. 15,000 Ethereum nodes are spread throughout the world, validating transactions made.[8] Each node holds a copy of the ledger; and each node competes to validate the transactions, being incentivized to use more computing power, but also being incentivized to stay honest. Transactions found to be invalid are discarded by other nodes, discarding all information and ether-exchange records associated with them.

While we keep a copy of all the transaction data (e.g. bid amounts, bid addresses, gift deployment times, etc.) in our centralized database, all of this is also logged in Ethereum for transparency and integrity. Furthermore anyone can check the values of the transactions at https://remix.ethereum.org. Except for the initial creation of the SmartGift by the charity, each action described in the first part of this section involves updating the status of the transactions in a fully auditable ledger, all of which are validated by public key cryptography.

Storing all the transactions on the Ethereum blockchain also creates a backup of the data integral to the operation of our platform. If for some reason our centralized database fails, the key components could be recovered from the blockchain.

Although, not explicitly implemented in our MVP, reputation systems are facilitated by blockchain because participants can use their Ethereum addresses as their public identities. While this is implicit in our platform, we could integrate this concept into our platform to create a rating and evaluation system tied to the participants' Ethereum public identities.

Blockchain enables a three-party escrow system. With Ethereum smart contracts we can send money to contracts and set specific conditions for the money's release. And because Ethereum uses digital currency (i.e. ether), we can seamlessly send ether over borders. Because these transactions are transparent

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[8] htttps://ethernodes.org, April 22, 2018.

and logged every time, SmartGive helps streamline auditing which would otherwise consume important resources and manpower. It also makes it easier for companies to report data and complete financial reports.

All of these blockchain affordances enable donor control in ways not previously possible. The donor can choose what cause to donate to, and be assured of the charity's identity. He can send his maximum donation to the blockchain and know it's safe until the charity decides to release it. And the bidding system prevents him from feeling any 'buyer's remorse' that might have resulted from overpaying for an item.

With this newfound control, we believe more donors will donate and donors will donate more. Small charities will then get the donations that they need.

How it Works

SmartGive is composed of a currently-deployed smart contract (i.e. the Factory), which enables donors to create a smart contract for each SmartGift. The Factory uses a SmartGift interface written in Solidity[9] and data provided by the charity and the donor to create a new smart contract for each donation (see Figure 1).

Each interaction with the smart contracts requires buying and using gas, a critical component in Ethereum's anti-denial of service scheme. Each computational step in a contract costs some amount of gas. Users pay for gas when creating a transaction. The amount of gas they need depends on how many computations their contract requires. And users can set the amount of ether he is willing to pay for gas. Higher prices for gas means the transactions may be validated faster than otherwise.[10]

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[9] Solidity is an high-level Ethereum programming language.
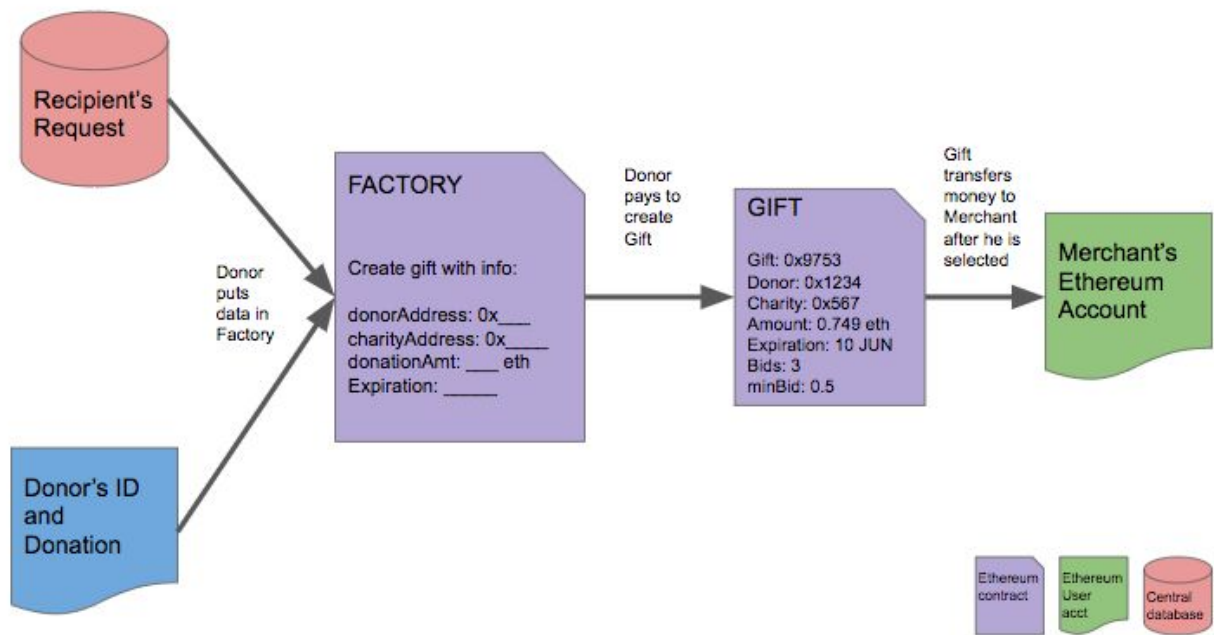[10] https://github.com/ethereum/wiki/wiki/White-Paper, April 22, 2018.

Figure 1. SmartGive generalized data flow through Ethereum contracts and user accounts

Gas was implemented in Ethereum to prevent denial of service attacks. Thus, there is a real monetary cost for every computation done on the network. We had to design SmartGive in a way that did not deter people from interacting because of gas costs. One key decision was to make the donor pay an initial amount (0.00000000001 ether) to the charity to cover the costs of the two transactions we asked the charity to make (i.e. Function *selectMerchant,* and Function *itemReceived).* The merchant also pays for every bid he makes. During testing, the cost of bidding fluctuated between 0.0005 and 0.001 ether, between $0.10 and $0.50 in April 2018. Figure 2 lays out every transaction in the minimal viable product and its approximate cost in US dollars.
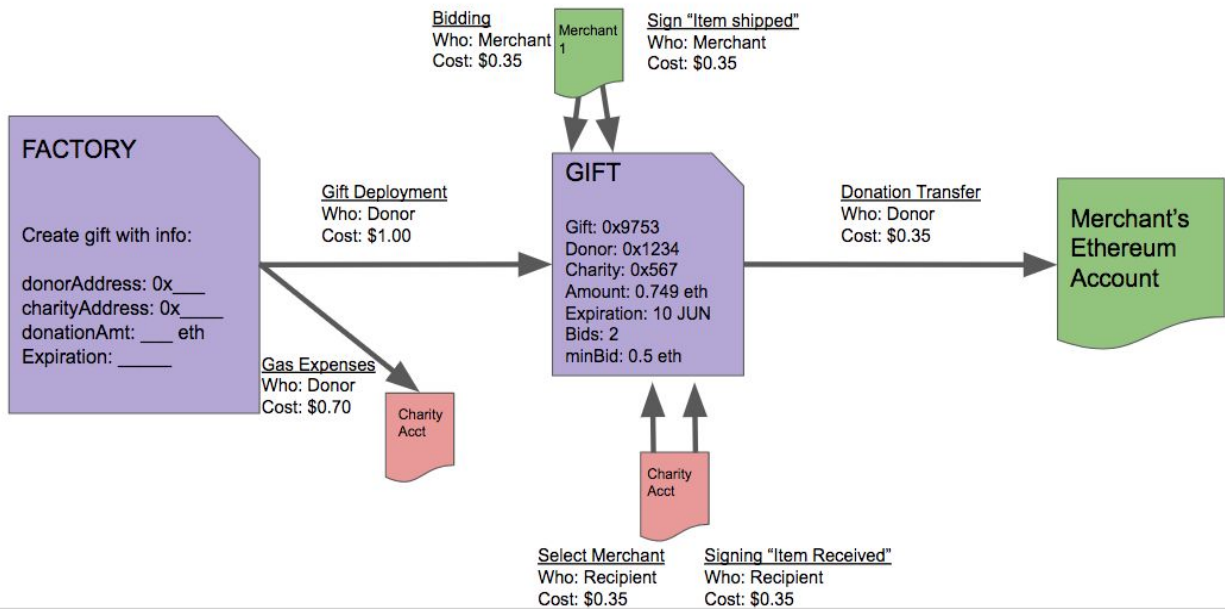
Figure 2. state changes involved in SmartGive and approximate costs in April 2018 dollars

Assumptions

In order to create our product and complete the project, we had to make a number of assumptions about the actors in the SmartGive model.

First, we assume merchants, charities, and donors would not be deterred from using ether as a currency due to its relative volatility to the US dollar. We also assumed participants have Ethereum accounts and have MetaMask, a browser plugin that enables interaction with Ethereum. Moreover, while we were interested in participants' willingness and ability to use cryptocurrencies in donations, this was not a primary goal of our project.

Second, we assume that participants would be willing to use the browser for all interactions with our platform. While we realized that mobile applications are increasingly popular, we discovered there are no mobile applications that enable

ether payments in the browser in the way MetaMask does on a desktop browser. Thus, we devoted our efforts to build an MVP for desktop.

Next, we concede that collusion between or among participants is impossible to prevent, but its effects and incentives are possible to mitigate. We attempt to incorporate elements that minimize these effects and incentives. Requiring the charity to choose one of the bottom three bidders, and requiring the donor to lock money in the contract are examples of implementations we introduced with this intention.

For the donors specifically, we assume they would donate more if there were more visibility around their donations, and found support for this in our survey results. We also assume that the merchant's bidding process would mitigate any potential buyer's remorse from the donor. The bidding would essentially lessen the market inefficiency caused by asymmetric information (i.e. even though the donor commits to a price that is too high, that doesn't mean that is the price he will pay).

For the charities, based on our surveys of potential donors, we assume the charities would receive more if they were more transparent.

Finally, for the merchants, we assume that collusion among merchants for bids is no easier on our platform than on other platforms. We also assume they would be willing to pay gas fees in order to bid. In future work, we hope to strengthen this assumption with merchant interviews and user testings.

OUR PROCESS

User Research

Initial Survey

After defining the initial problem space in charitable giving, we sent out a survey as a generative research strategy. The survey contained 15 questions and the purpose was to discover any issues respondents faced with current donation platforms, level of trust for different methods of donating, and type of information they prioritized when they want to donate. As a final question, we asked the survey respondents to provide us their email address if they were willing to speak with us about their experience with charitable giving. We received about 85 responses; of those, 82% donate at least once a year.

Discovery 1: Visibility is important

While donors don't feel the need to designate where their donated money can be spent, visibility is still very important. When asked the question, "How will these factors increase your willingness to make a monetary donation?" 76.3% voted that 'Visibility into how my money is spent' as either the most or second to most important. Closely, 'Recognizing the charitable organization I'm donating to' was also a factor that would increase their willingness - 62.7% voted it as either the most or second to most important (see Figure 3).
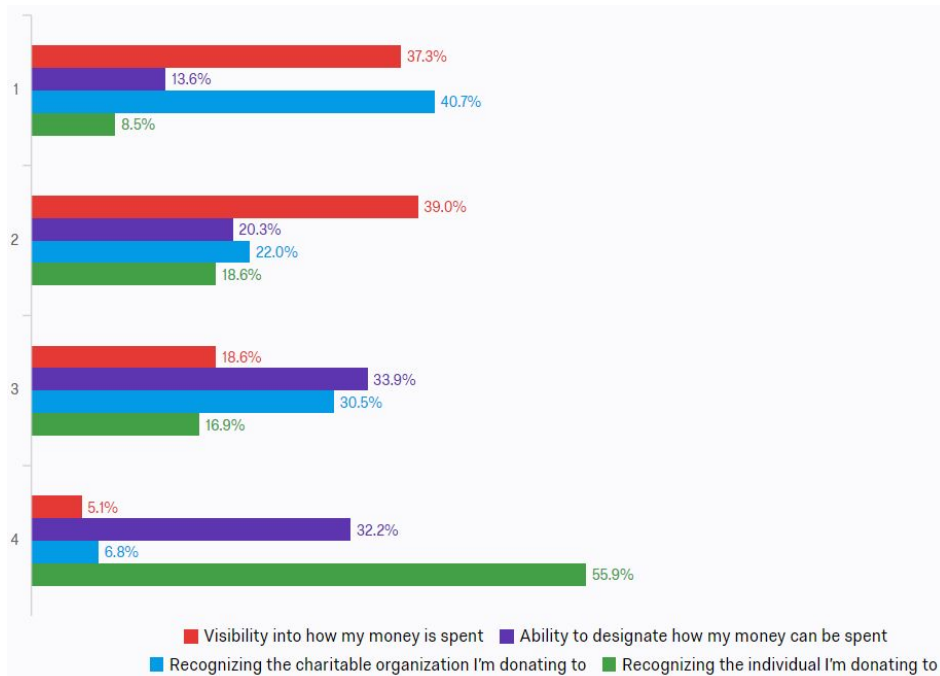
Figure 3. "How will these factors increase your willingness to make a monetary donation?"

Moreover, when asked the question "How important is it to you that you know how your charity spends your money," 67% of the respondents chose 6 or 7, indicating that it is 'extremely important' (see Figure 4).
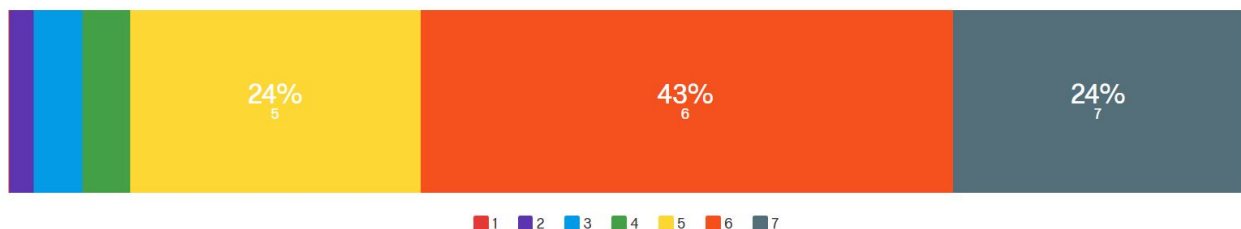

Figure 4. "How important is it to you that you know how your charity spends your money?"

Discovery 2: Highest trust in charity organizations

Of the proposed methods that donors can contribute money to when there is a disaster nearby, more than half of the respondents (56.2%) chose the Charitable Organizations as the most trusted to receive and spend their donated money (see Figure 5).
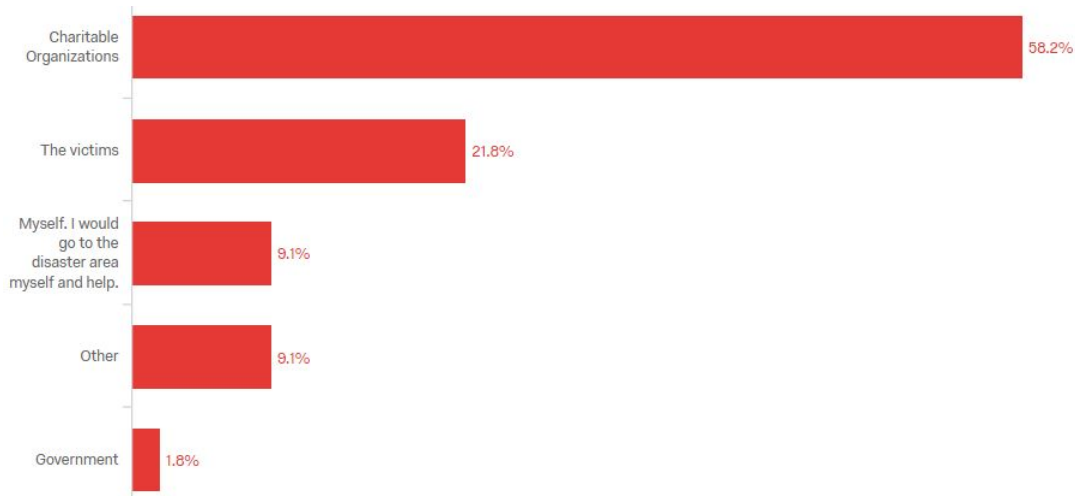
Figure 5. "Imagine an earthquake happens in some 100 miles from your hometown. You want to donate money to help the victims. Whom do you trust the most to receive and spend your money?"

This corresponds with the respondents' level of trust on how well they think these different groups of people will use the money as they say they would as depicted in the graph below (see Figure 6). Again, more than half (52%) scored 4 out of 5 on 'Charity Organizations,' score of 2 was the highest for 'Peer-to-Peer' such as GoFundMe, and a score of 1 was the highest for 'People on the streets.'
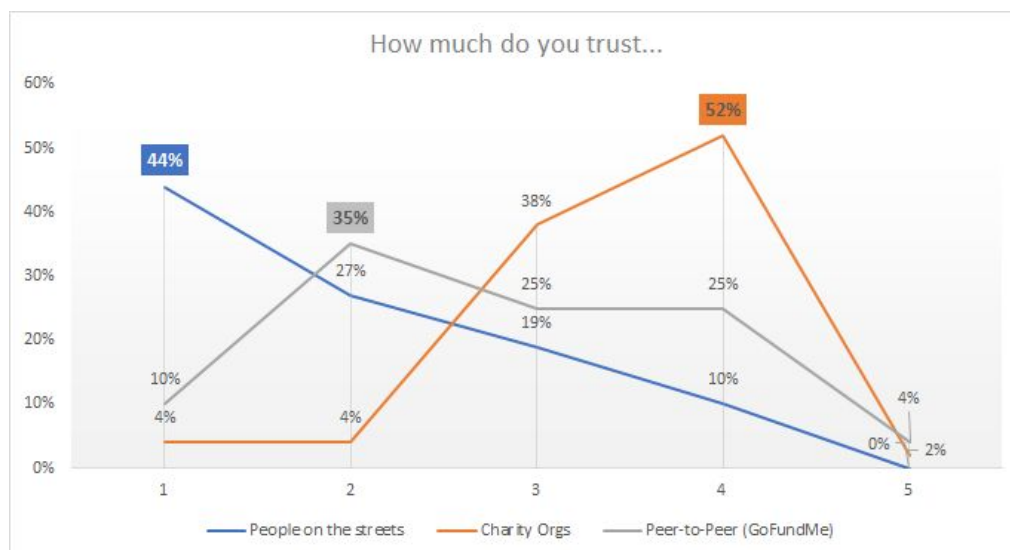

Figure 6. Compilation of questions, "To what extent do you trust people asking for money on the streets/charity organizations/peer-to-peer online platforms? 1 being the lowest trust level, 5 - the highest"

We conducted interviews with 3 different target groups: 6 donors, 3 non-profit organizations, and 5 direct fundraisers. The donors were among our initial survey respondents who provided their contact information and indicated that they have experience donating at least once a year. We define non-profit organizations as a 'middleman,' allowing charities and other organizations to post fundraising projects on their platform for the donors to search and discover. Direct fundraisers include local and smaller charities working on the ground and individuals raising money for a specific cause.

Donors: Trust, Connection, Convenience

From the donor interviews, common themes were trust, connection, and convenience. They indicated that they would donate to those they found to be *'trustworthy,'* which involves some type of verification to establish. An interesting finding was that some would only donate to bigger organizations such as the Red Cross because they have "so much distrust of" peer-to-peer platforms, and some only to personal fundraising because they *"try to stay away from the huge, huge organizations."* In either case, the majority of our interviewers looked to social media sites or word-of-mouth as critical sources that help make their decisions to donate, portraying the need to verify via personal connection. One interviewer who made the donation on Facebook *"was just going off of my friend and I trusted that she did the research."* Another way they made the verification was through a third party auditing organization, such as looking at Charity Navigator. One person even stated, *"I wasn't going to donate money again until they [the charity] moved in the direction of being certified by an outside party."*

Most importantly, all interviewers accentuated the need of *'convenience'* when finding a charity or making a payment, especially online. When looking to donate for a specific cause, they said that *"[charities] come across my path,"* usually on different apps they use daily such as CNN, Facebook, or Snapchat. Additionally,

they strongly preferred simple and quick payment methods - *"It was a few clicks, entered my visa number, and hit send - it was really simple."*

Non-Profit Organizations: Efficiency, Due Diligence

Common themes that emerged after interviewing non-profit organizations were efficiency and due diligence. Because these non-profits provide a platform for other charities and organizations, the non-profits ask for certain types of information, such as the amount needed and why. When we asked if they can ask the charities to provide more specific information such as where the money is exactly going, the non-profits said this request will cause inefficiency to the charities' operations. Furthermore, because they act as a 'middleman' between donors and fundraisers, they perform a lot of due diligence before they allow anyone to post fundraising projects on their platform, including sending volunteers on-site and third-party system. They highly depended on a third-party system, such as Charity Navigator, to verify the fundraisers' legitimacy as well as their own. To ensure the donors are aware of their money's impact, the non-profits usually collected and posted pictures and updated their stories.

Direct Fundraisers: Awareness, Hands-on

Of the ones we interviewed, direct fundraisers either worked on the field as a very small and local charity or managed fundraising campaigns for them. In order to raise more funds, they agreed on the necessity of spreading awareness but they were too busy making a living on their own, such as working a double shift as Uber driver. On the contrary to the non-profits, they didn't think third-party verification system is very reliable and they were willing to provide details about their spending if necessary.

Competitive Analysis

Competitive Usability Testing: GlobalGiving.org

We conducted usability testing with think aloud method on a potential competitor's website to guide our initial mock-up of our prototype. Some positives elements we learned from this research method were the implementation of large visuals and project titles to easily identify projects, clear payment process, and easy way to discover the 'about' page. At the same time, some criticisms were excessive filter options overloading the webpages and unclear way of determining the final donation amount.

Competitor Review

Additionally, we created a competitor review of different online donation methods, from a site that offer a collection of projects to personal fundraising pages to blockchain enabled platforms.

GAPS	STANDARD	EXCEPTIONAL FEATURES
Clarity of goals varies based on text given by fundraiser	Accepts Credit Card and PayPal payments at a minimum	8 different ways to complete a transaction **[GlobalGiving]**
Ability to confirm the use of funds per charity for specific programs	Takes no more than 3 - 4 pages to complete a donation	Total integration with a social media account **[Facebook]**
Clarity on how much of donation goes towards overhead	Secure transactions (HTTPS, SSL)	Track goals met by the organization over time **[Alice]**
		Refund Guarantee **[GoFundMe]**
		Direct Link to 3rd Party Verifier **[Facebook]**

Table 1. Summary table of categorizing competitive analysis

By extracting required features of donation platforms and nice-to-have features we heard from interviews, we mapped out to see whether each competitor met each expectation. We then separated the results into three categories: exceptional

features we saw from specific competitors, standard features that all competitors adhered to, and gaps that no competitor filled, or opportunities for SmartGive. Summary of these categories is as follows in Table 1. [See Appendix 1 for more detailed grid].

Product Design

Prototypes

Based on the feedback we heard from conducting competitive usability testing on GlobalGiving's website (globalgiving.org), we created paper mock-ups of SmartGive's website, incorporating some positive features and modifying the negative ones. Afterward, we used Balsamiq and Illustrator for more defined prototypes and constructed basic user flows. [See Appendix 2 for example of prototypes]. With these set of prototypes, we built the front-end for critical pages needed for donors to test the initial design and user interface. We decided to test with donors first as they are the most easily accessible for testing purposes.

Heuristic Evaluation

We quickly tested these initial set of pages with heuristic evaluations performed by three experts proficient in design and website development. We assigned simple tasks to test the general capability, features, and content knowledge. Afterward, they each completed a set of ten questions based on Nielsen's 10 Usability Heuristics for User Interface Design.[11] We categorized the feedback into different priority levels and made the necessary modifications before diving into our main usability testing with donors. Example of the categorization is shown in Table 2. [See Appendix 3 for before and after comparison of website].

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[11] https://www.nngroup.com/articles/ten-usability-heuristics/, Jakob Nielsen. January 1, 1995.

CRITICAL PRIORITY	MEDIUM PRIORITY	LOW PRIORITY
Minimize text on the website	Show project tags (e.g. hashtags)	Clarify how the website works
Allow multiple ways for selecting projects	Allow users to change donation amount	Include ability to contact the charity program manager
Clarify subtitles in project description page	Make texts bigger	

Table 2. Summary table of categorizing feedback from heuristic evaluation

UI IMPROVEMENTS	UX IMPROVEMENTS	UNANSWERED ?S
Use bullet points for the charity preview card	Add ability to change donation amount	Does the user clearly understand what happens after they select to donate?
Show what your money is going to be used for in addition to what the charity does in the preview	Include a place for follow-up information about where the charity purchased the items	If the merchant fulfills the request at a lower price, does money get refunded to the donor?
Incorporate explanation for the method of payment (ETH)	Add ability to donate to specific parts of the request	If the merchant fulfills the request at a higher price, does the charity have to raise more funds through the platform?
[12]Offer live conversion rates for ETH → USD	Give charities the ability to run campaigns that multiple donors can donate to	

Table 3. Summary table of categorizing feedback from usability testing

Usability Testing + Reaction Cards

After modifying the pages based on heuristic evaluation results, we performed think-aloud usability testing with potential donors on SmartGive and also used

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[12] This functionality was implemented later, after the user research.

reaction cards to gauge their expected emotions from using a donation site and how they actually felt after donating via SmartGive's platform. [See Appendix 4 to see pictures]. By capturing videos and audios of users completing specific tasks on SmartGive, we gained insights of the site's usability as well the discrepancy of their expectation to actuality. Again, we categorized the feedback to better inform how and what to modify: UI improvements, UX Improvements, and unanswered questions (see Table 3).

TECHNICAL ARCHITECTURE

Overview

The SmartGive platform runs at three different levels. At the simplest level is the front end, how the website presents itself to the user. At the deepest level is the Ethereum blockchain, a transparent computer where anyone so inclined can look at the state of the SmartGive system (who has donated what to whom, which merchants have been good about fulfilling their requests, etc) and be guaranteed that we as developers have not manipulated the system in any way.

For communicating between those two levels we have our database, which abstracts the slow, convoluted experience of dealing with Ethereum away from the front end.

In this section, we shall zoom in on each of these three technologies in turn and look at how they connect to each other.
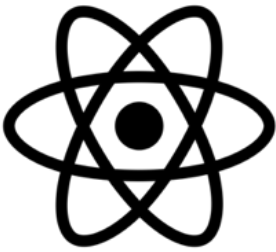
Frontend
React

Database
MongoDB

Blockchain
Ethereum

Technologies and Frameworks

React

The front end of the website uses React, a popular functional framework created by Facebook. We use Material-UI library for many of the elements on the website (that's why it looks sort of Google-y). The How it Works section uses the React Skrollr library.

It is important to note that the SmartGive website is not optimized for mobile as MetaMask, the library we use to connect the front end to Ethereum, does not work on mobile and therefore neither does our website.

MongoDB

The database is built with MongoDB and uses the Mongoose library to communicate with it. The database connects through the front end via a simple express API. It connects with the Ethereum using Web3.

When a potential recipient creates a request, before that request is fulfilled it only lives in our local database. Once a donor agrees to fulfill it, the gift data is written to the blockchain. From then on, the database simply reflects what is on the blockchain.

At this point, SmartGive only exists on the Rinkeby Testnet, an Ethereum blockchain where currency is free to generate. No technical mechanism prevents us from deploying to the real live Ethereum blockchain, but speculation around the price of ether has caused development costs to be prohibitive.

Individual gifts are tracked by a SmartGift Factory that lives at a stable address. That way, one looking to explore or verify gifts on the blockchain has a single place they can go to in order to find them.

To read from the Ethereum blockchain is free, but to write to it (ie change the state of the gifts on it) costs ether, or "gas". Since we are only working on the testnet where currency is free, these gas costs have not been a major concern, but communicating about them clearly and deciding how best to deal with them is an issue we look at in Further Developments.

Bringing It All Together

The main goal of our architecture is to have the front end, back end, and blockchain to be as containerized and abstracted away from each other as possible. Communication should as much as possible be one way. Therefore, we have designed two engineered two separate approaches for reading data (such as looking at someone's profile or looking at their request) and writing data (such as fulfilling a request with a donation or confirming a shipment.) In general, the goal is for all three elements to have a read-only or write-only relationship with every other.
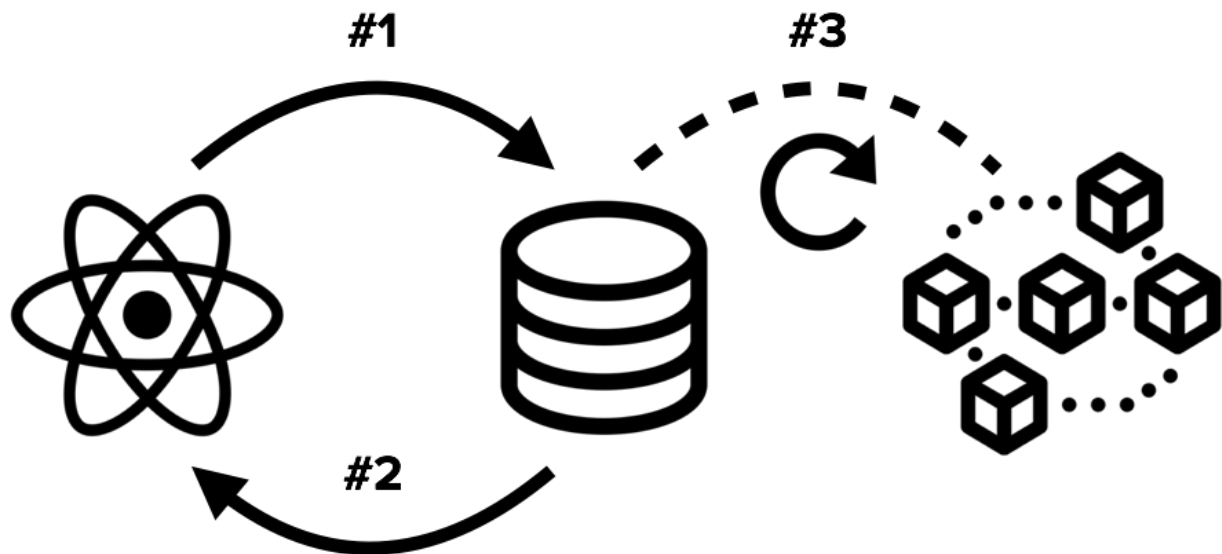
When a user visits a web page that requires reading from the database, the following occurs:

1. The front end hits an API to ask the database for some set of information, say data about a request a charity has made.
2. The database, if it has that information, replies with it.
3. The database regularly polls the blockchain to see whether or not it has been updated. If it has, the database reads from the blockchain and updates the stored gifts accordingly.
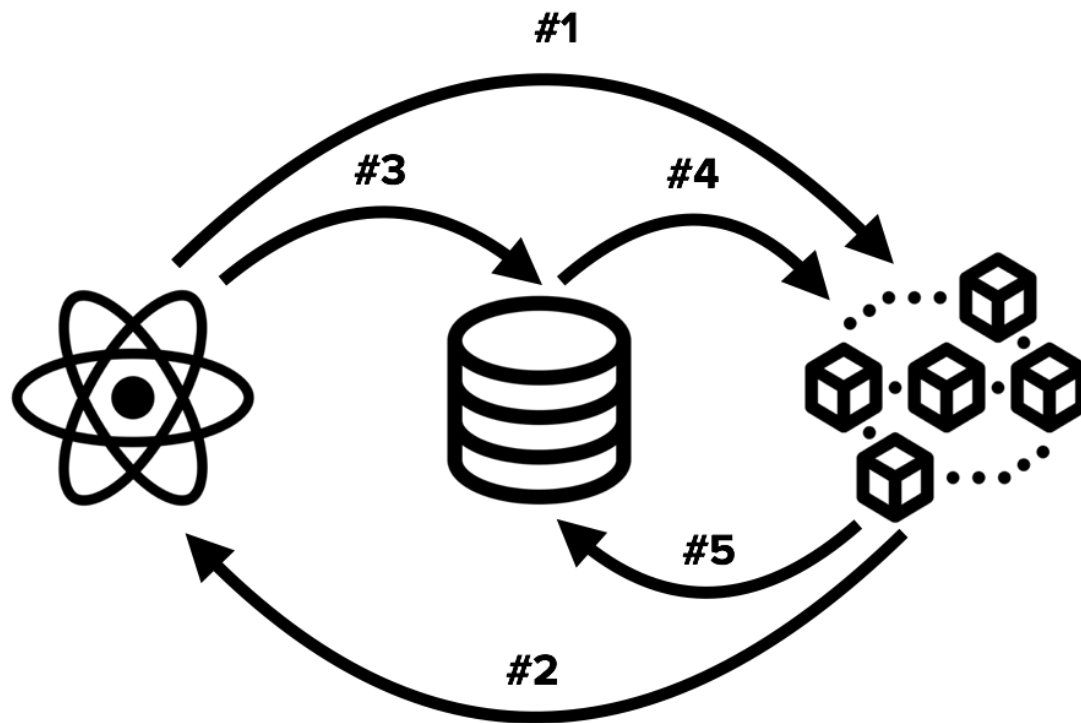
When a user performs an action that changes some data on the blockchain, the following occurs:

1. If for example, someone donates money to fulfill a gift, the front end will open MetaMask and send that data/currency to the Ethereum blockchain via Web3.
2. Web3 returns whether or not the update to the blockchain was successful
3. If the update was successful, the front end informs the back end that it is out of date. Note that it does not directly update the database—the blockchain is always the source of truth.
4. The database asks the blockchain for an update
5. The blockchain returns the latest status of all the gifts on the blockchain, which will be reflected on the front end whenever a user visits the website.

WEBSITE

www.smartgive.me

BUSINESS MODEL

To sustain SmartGive, we require expenses, like hosting and maintaining a centralized database and web server. For recruitment expenses, we estimate approximately $30 per customer acquisition. We believe they could be recruited through marketing during charitable events like 5k runs and gala balls. After six months of operation, we hope to have acquired 20 merchants and 50 charities and to have completed 100 donations. To cover these expenses, we are considering two business models.

The first one, quite obviously, is a non-profit model. Like Wikipedia whose services are free we could hold one fundraising campaign per year. That way, we would not only keep our service free for our user, but also had a good understanding of how important and appreciated our work is.

The second model is a subscription model for both merchants and charities. While we would refine the details after more market research and feedback, we would start with offering merchants either a $10/month subscription plan for merchants, with unlimited bids, or a 5% fee per-winning-bid, but with no fee for the first two winning-bids.

Charities could choose between a $8/month subscription fee, or a 5% fee per request, with the first three requests free.

FUTURE DEVELOPMENTS

Mobile version

According to user research, many of our potential users don't have desktops or laptops. However, they usually possess smartphones. We would like to develop a mobile version of SmartGive to make posting a request and bidding accessible for a wider audience.

MetaMask or other crypto wallet integration

Due to time restrictions, we did not integrate MetaMask sign up into our platform and simply call it if it is already installed on a user's computer. For the frictionless onboarding of those users who don't have a MetaMask account, we need to integrate this into SmartGive's website. At the same time, if we develop a mobile version, we will probably need to say goodbye to MetaMask and use another Ethereum wallet, because MetaMask does not have an official mobile version.

Identities

As of today, the user's public-private key pair represents the identity: the possession of the private key determines the identity ownership while the public key helps verify this identity. Like everything on blockchain, the identities are irrevocable, immutable and accessible. But sometimes keys get lost, so the record of transactions associated with these keys gets cut off. Solutions like uPort[13], based on an Ethereum smart contract, help solve the problem of cryptokey management and persistent identities. The uPort Registry is crucial for identities verification. They are not necessarily the copies of people's real life identities (just like Facebook accounts), which means the anonymity, or, rather, pseudonymity, on blockchain will remain. It also doesn't prevent a user from

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[13] https://www.uport.me Accessed April 24, 2018

having multiple identities. But it is an effective solution to prevent identity theft and loss.

Reputation system

Having a trustworthiness rating for every member of the platform will prevent fraud in the platform and help facilitate the interactions. Some of the implementations of such a reputation system include past Ethereum transactions' analysis, made both via SmartGive and other Ethereum-connected platforms, and fetching social networks information about a user. We believe, all three types of our users - donors, merchants, and charities - should have a reputation score.

Crawler

Since transaction transparency is the main distinction of SmartGive, we want this feature to be obvious and convenient to use. For our MVP, we decided to make use of an existing solution for Ethereum - Etherscan. Etherscan keeps track and makes searchable every transaction on Ethereum blockchain, including the SmartGive transactions. As a future development though, we would like to create an interface on our front-end that would crawl Etherscan and make the SmartGive transaction search and sorting frictionless and visually appealing.

Monetary donations

We intentionally limited our MVP to in-kind donations worth $10-500 and excluded tobacco, alcohol, real estate, art pieces and other assets with a fast-growing appreciation. We hoped it would mitigate the risk of money laundering and players' collusion. However, in the future, we would like give a donor an option to donate money to the charities with a good rating. For this to be possible, we need two new elements for our platform. The first is the reliable rating system mentioned above. The second element is a technical solution for tracking spendings from the Ethereum account, which would help to maintain SmartGive's high transparency level.

ACKNOWLEDGMENTS

Appendix

1. Detailed grid view of competitive analysis.

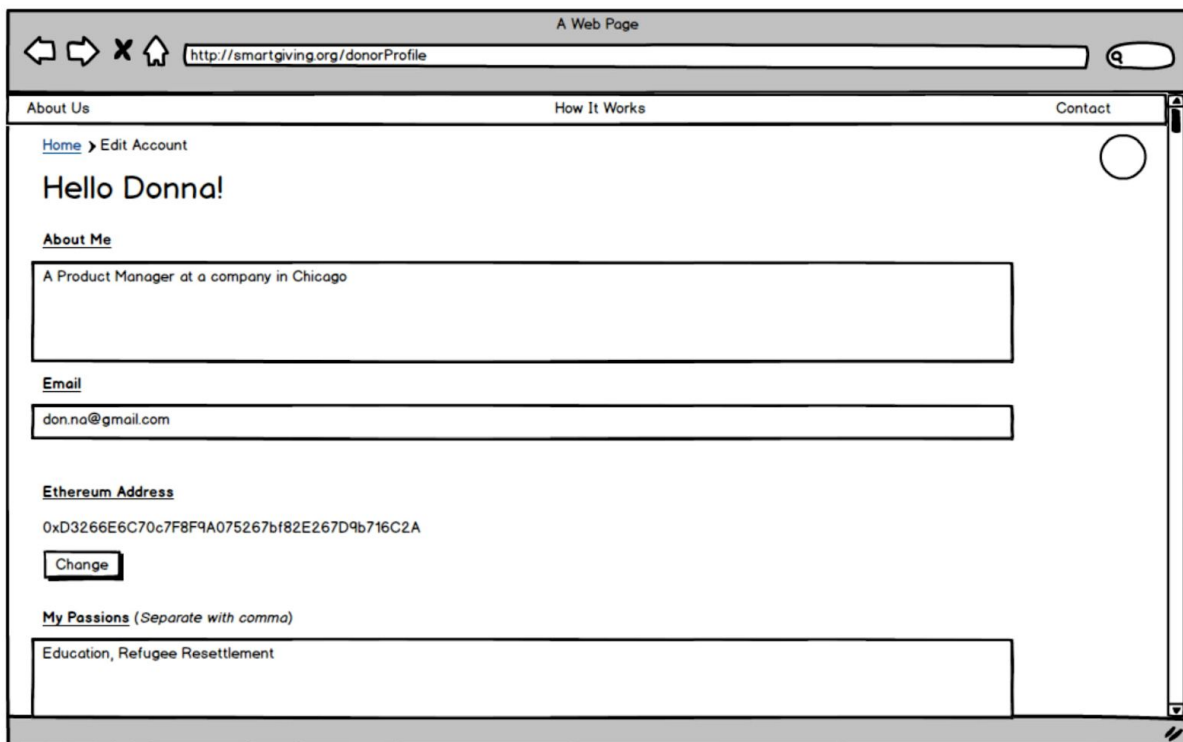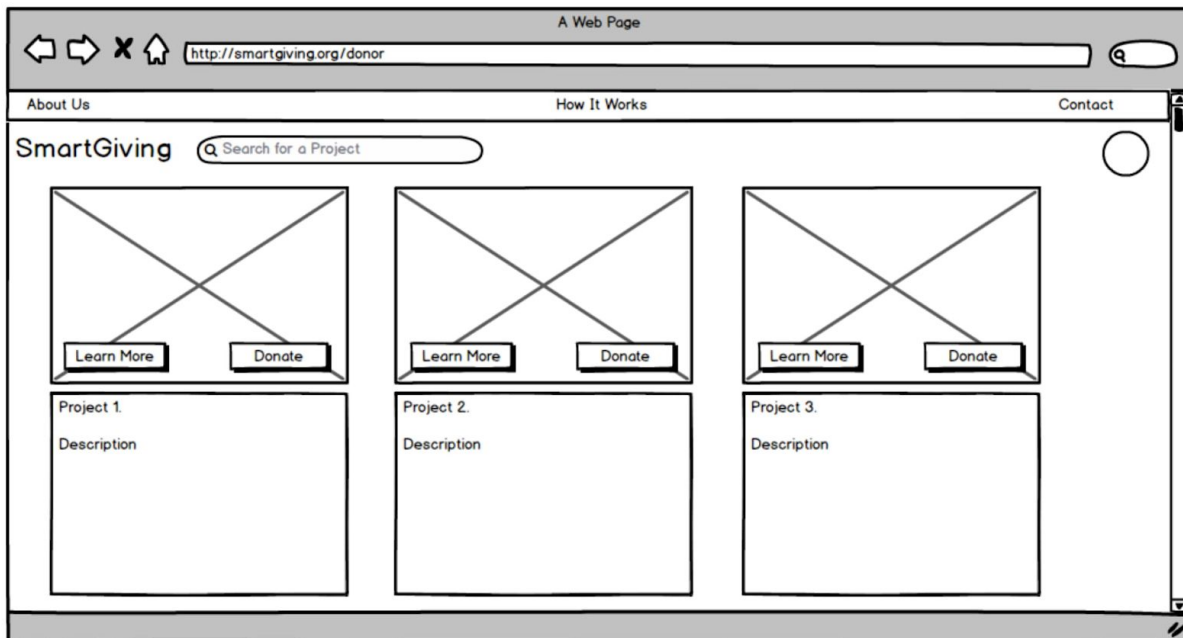| Description (red = gap, green = oppty, blue = wow) / General Features	COMPETITORS						
	Platform of collection of charities/projects: e..g GlobalGiving	Large charity organizations: ICRC.org	Personal fundraising: e.g. GoFundMe	Social media fundraising: e.g. Facebook	Direct donation: e.g. Homeless person; local drives outside a store	Alice.si (pilot only)	Bitgive
Clear purpose statement of the organization/platform	Clear from homepage both platform/platform	clear organization statement on homepage	Emphasis on GoFundMe and fundraisers (search and categories to find charities)	Up to organizer? Post or notification is first.	No	Yes	Unclear how it works
Indication of third party verification (e.g. Charity Navigator)	Notable companies listed as partners	no	Not third party - list of donors, and guarantee tho	Direct link to GuideStar	None	Outside validator?	Not clear
Project Identification							
Clear summary of challenge/ goal of project	Lists challenge / goal in clear sections	no clear challenge by project	Free text story and updates (up to cause)	Up to organizer	No	Yes - by dollar amount received	Depends on supported charity
Provides information about recipient	Summary and solution sections plus vetting badges	no clear recipient	Depends on cause	Up to organizer	If direct, yes	Yes - link out and video	Yes
Indication of recipient's credibility	Uses badge system to indicate	no	No, but guarantee & certified charities?	Link to guide star	No	View chain of progress over time	Not really
Visual aid to project/description (e.g. video, pictures)	Lists reports and photos	photos	photos If provided	Not really	The recipient	View chain of progress over time	If provided y organization
Clear indication of amount to give	Donations listed by expenditures, sometimes non descript ("relief")	yes, in multiple currencies	No	Suggested amounts	No	lots of goals and amounts expressed	Not currently
Ability to share via social media	FB/tweets posts provide picture, title, and summary	presence on several social media	Yes - FB	Integrated with FB	No	Yes, but crappy posts	Social media presence for org
Transaction Process							
Secure Transactions (e.g. HTTPS)	Entire site	Yes	YES	Yes	No	No	Maybe
Variety of Payment Methods (e.g. credit card, paypal)	Gift cards, check, paypal, credit card, stock, wire transfer, estate planning, charities aid foundation	paypal, credit card	credit card only (unless "CERTIFIED charity") - can use paypal	Credit card / pay pal	Cash	Credit card and ETH	Bitcoin
Minimal/Simple Steps to Complete Transaction	Can be done in 4 steps (also has a cart for multiple charities)	3 steps	3-5 steps (depending on start)	3 steps	2 (take out wallet, give cash)	UNK	Uhh... sign up for membership?
Provides information about how the money will be used	Possibly listed with each donation step (list of amounts)	No	Up to donor (unclear)	Depend on organizer	Maybe	No, but shows how it is tied to goals.	GiveTrack.... but how does it get to charity
Provides tracking information of donated money	No	No	No	FB indicates if direct to charity	Direct if to homeless	Yes, shows my impact	Yes, on give track, but unclear how
Indication of amount going to overhead	No	yes	No	No	Maybe - not for Salvation army	UNK	No
Indication of additional amount to original payment amount, if any (e.g. donation to the actual platform)	Yes, but might be automatically added	assumed no	Yes if opted in	Yes, FB says they take 0%	yes	UNK	No
Overall							
Aesthetics	Good	Decent	Meh	Looks organic to FB	N/A	Decent but wordy	NO

2. Example of paper and low fidelity prototypes of website design and development.

A Web Page

http://smartgiving.org/donor

About Us   How It Works   Contact

SmartGiving   🔍 Search for a Project

Learn More   Donate   Learn More   Donate   Learn More   Donate

Project 1.

Description

Project 2.

Description

Project 3.

Description

A Web Page

http://smartgiving.org/donorProfile

About Us   How It Works   Contact

Home › Edit Account

Hello Donna!

About Me

A Product Manager at a company in Chicago

Email

don.na@gmail.com

Ethereum Address

0xD3266E6C70c7F8F9A075267bf82E267D9b716C2A

Change

My Passions (Separate with comma)

Education, Refugee Resettlement

3. Example screenshots of before and after of web development with feedback from heuristic evaluation.

Clear options to learn more

Large visual and project titles

Shorter description on home page
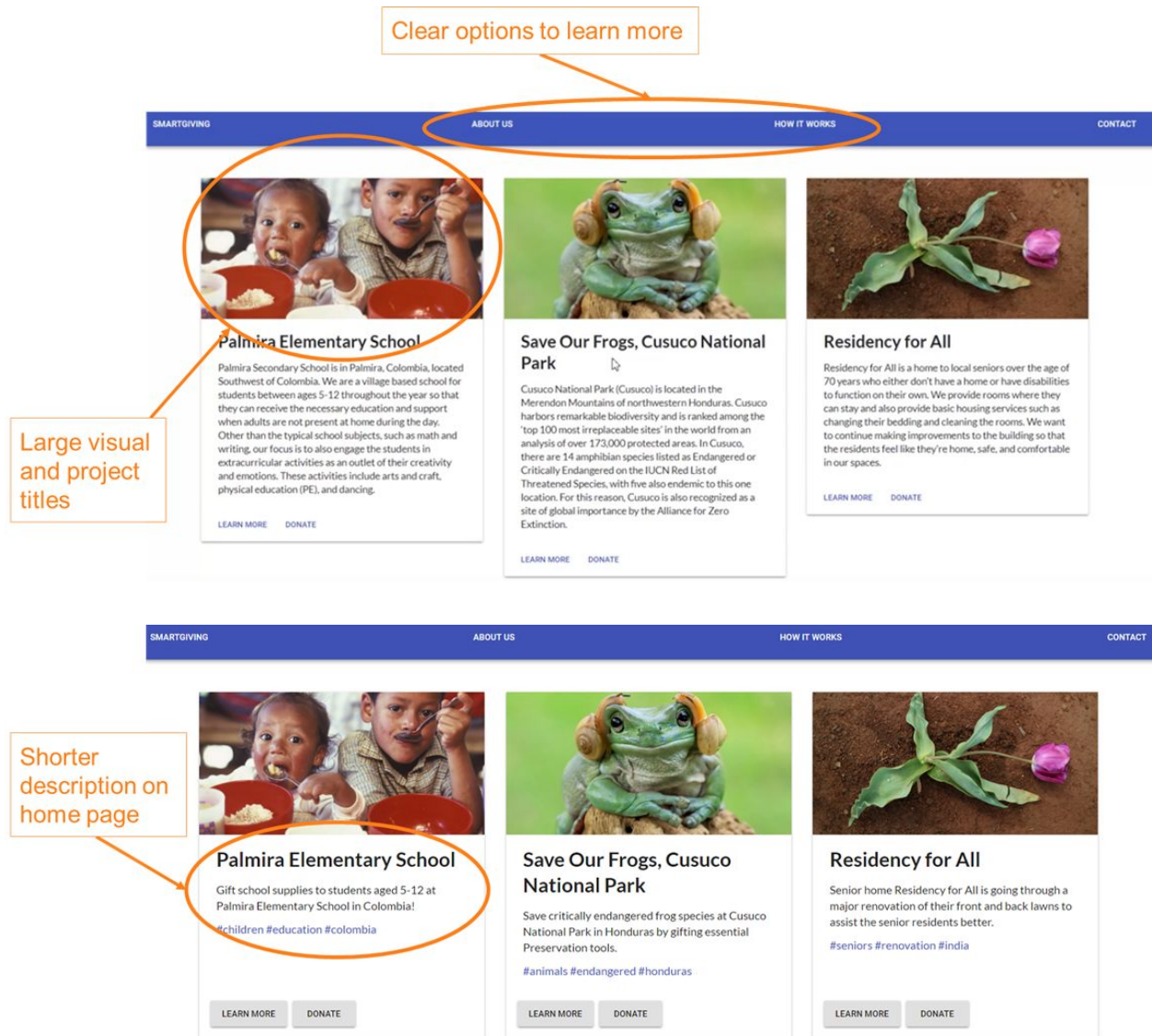
4. Reaction cards incorporated with usability testing.