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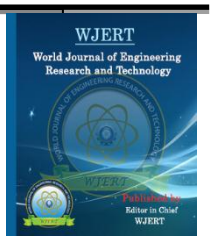

# CHARITY MANAGEMENT SYSTEM USING BLOCKCHAIN TECHNOLOGY

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## ABSTRACT

The charity organisations are often being criticised for their lack of transparency. They are in a sort of turmoil as people who are willing to donate money to charitable organisations take into consideration the trust factor i.e. they want a transparent view of the organisations in question. There is at time not a clear representation of the cash flow to the vulnerable ones in society and it is drastically increasing as a concern to donors. Many charitable organisations face several complaints, people keep questioning what is being done with their money. In addition, there is a focus on organisations who cannot set their time management on selecting the real needy ones or focusing their monetary mechanism; acting as a medium to help the vulnerable segment of the society. Some people might be acquiring help and support from various organisations, while some might be completely left behind. Blockchain as a underlying technology of Bitcoin system provides a new solution for the charity system in terms of technology. This paper proposed a charitable management system to organisations in such a way that the needy ones can be tracked and therefore achieving the ultimate goal of any charity organisation. The technologies being used are NodeJs, NextJs, Solidity, Semantic-UI-React which prove to deliver a final product capable of managing the charity features efficiently. The system enables a charity organisation to create a charity event that is broadcasted to all the users who can, in turn, donate. From there on, to deliver money to the destitute, organisations can create a request that requires authenticity verification by potential donors of the event. The system is expected to increase the transparency of charities and enhance the public's trust in charities as well as promote the development of philanthropy through blockchain-based technology.

## 1. INTRODUCTION

A charitable organisation (also known as a charity) is a trust, company, or unincorporated group founded exclusively for charitable purposes. A charity goes beyond offering aid to the needy or disabled, stretching to spreading happiness, and supporting other noble causes for the betterment of the whole of society. However, the charity system is in a tumultuous situation as nowadays people are adopting a selective approach to donate money. This is mostly due to trust issues concerning the proper use of the donations. Malicious intentions with charity money can cause a massive rupture in building trust between donors and an organisation. Donors, i.e. people who are willing to give money for a good cause, seek transparency for the money transactions together with results where the needy people are being helped.

The massive concern of charity organisations is the trust factor as donors do not have a clear view of where their donation is going. The other concern is that organisations cannot help many people due to a shortage of public funding. A considerable amount of money cannot be raised as they are missing an online presence thus complicating things for people who want to donate money, but the association collecting the money is not within the region that they are found. Consequently, people with a greater need for the money are left behind due to bad management of funds. The objectives of the proposed system are to devise a system that will help charity organisations in creating events while providing publicity for the causes they are fighting for; support charitable organisations in having a good overview of the progress of their several charity events through automated reports; employ the use of a crypto wallet from which people will be able to donate money to the charity causes; demonstrate transparency in the expenditure of donations by the use of requests from which donors can have a vote whether to give the money or not; compose of an accessible platform available everywhere and anytime using an internet connection; generate an instant view of the progress of all the events created by all the organisations.

## 2. LITERATURE REVIEW

### 2.1 Charity Management System

A charity organisation can be seen as a non-profit organisation whose primary objectives are about helping people in need, abandoned/mistreated animals, and ecological causes. They carry their operations through fundraising activities which include money collection programs in public places, advertising on social media platforms, and even on radios. Their

main income comes from public donations. In 2016, a survey carried out by philanthropy website, compassion.com, revealed that the largest source of funding was being filled by individuals at a cap of 16 billion dollars which sums up about 72% of total giving, followed by foundation fundraisers totalling 15% of all donations and preceding two types of donations by bequests and corporations summing at 8% and 5 % respectively. Charitable institutions may be (1) Animal charities that resume in zoos, aquariums, and wildlife conservation; (2) Environmental charities such as environmental protection organisations which are correlated to nature reserves; (3) International Non-Governmental Organisations which consist of disaster relief organisations, humanitarian works, peace, and respect of human rights organisations; (4) Health charities that deal with all health-related issues; (5) Education charities offering scholarships to students that cannot afford higher studies in developing countries; (6) Arts and culture charities that help struggling artists to make a living through their work by giving them funding to expand their research and improve the world of arts and cultures. All these types of charities have common functions which may be represented as in Figure 1. They have a business plan which is engineered by the management team from which they develop services to improve their help and get a better hold of the impact of their charity events. From the funds they gather in their events, they save some for investment purposes, money which shall be used to create other events, and the money left is distributed to the several causes being undertaken by the organisation. The organisation also has a team in the backend which provides support with logistics, communications, finance, IT equipment, and so on.

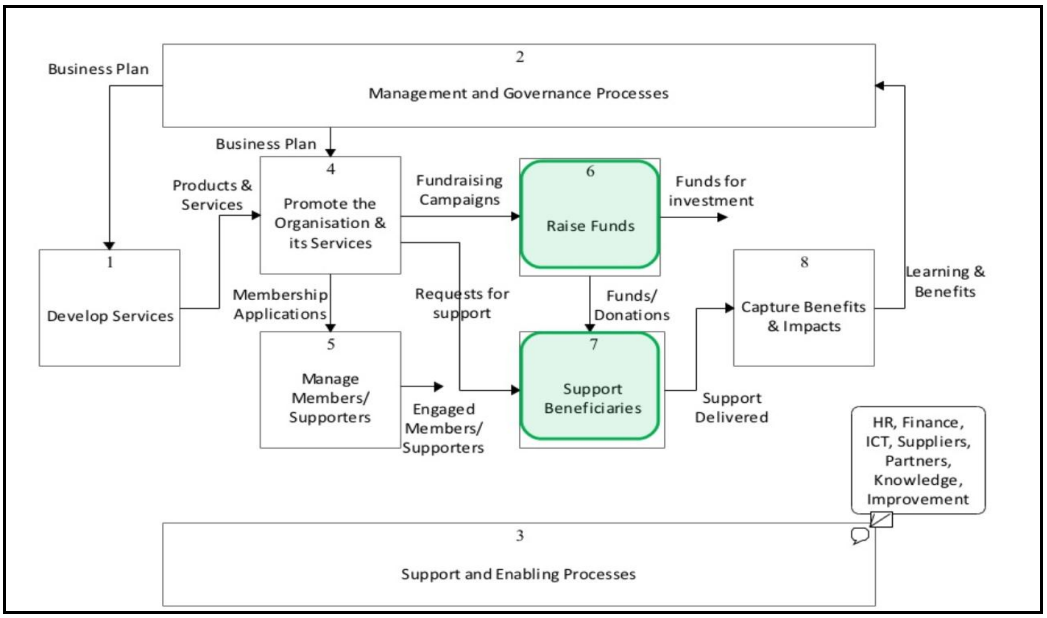
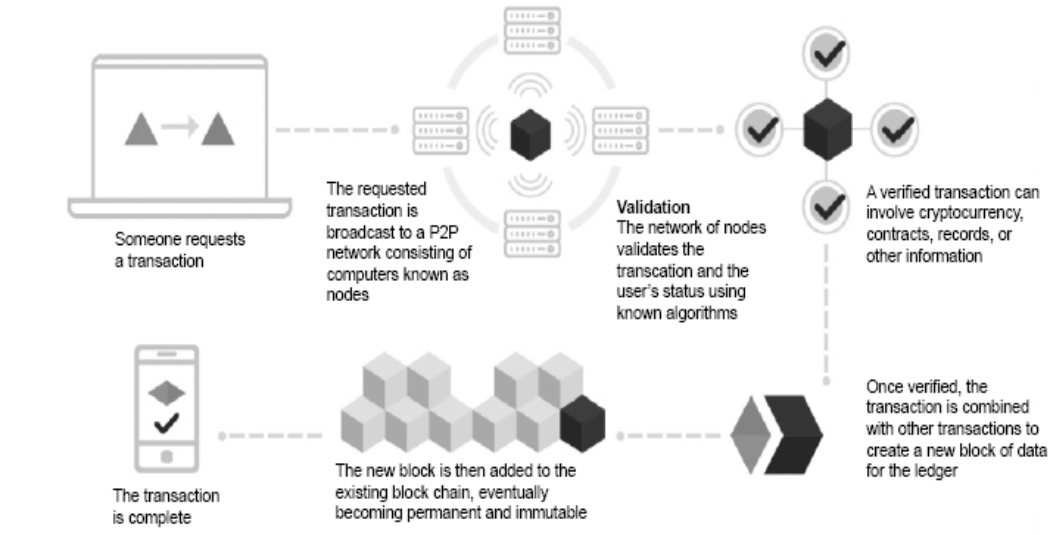



**Figure 1: Processes of a charity organisation.**

### 2.2 Blockchain Technology

Blockchain technology was developed as the core infrastructure of the Bitcoin crypto-currency in 2008 (Nakamoto, 2008). It tackled a particular problem of the digital economy: the topic of double-spending, including how to guarantee that the same financial currencies, like bitcoin, are not invested more than once (Zwitter, 2018). The economist (2020) is addressing the Blockchain technology's tremendous potential outside its cryptocurrency applications. In many other cases, Blockchain was subsequently viewed as a revolutionary tool that will transform the environment as radically as the Internet did as in the 1990s. Blockchain in fact is a shared ledger that holds a transaction register asset over a peer-to-peer (p2p) network. There are many forms in which the term "asset" may be interpreted: not only as capital but also as possession, power, contracts, products, and personal information (Warburg, 2016). Although p2p networks often function for file storage, such as images or music. Blockchain functions differently in the way that the transaction value is not duplicated. Alternatively, the system records that interest was passed over a network from one individual to another (Balva, 2017). It distinguishes Blockchain from cloud applications and places Bit Torrent similarly to peer-to-peer networks. Blockchain efficiently operates without any central control system and keeps the transaction history in data files contained in cryptography. Since it is repeated on every device belonging to the network, the database of all transactions that have ever existed is unchanging, constant, and transparent (Drescher, 2017). Figure 2 provides a graphic representation of the blockchain technology processes.




Source: Adapted from UNDP (2018).

**Figure 2: Blockchain Processes.**

Blockchain works on a consensus mechanism with a more logical level and depends mainly on two elements: hashing algorithms and proof of work. Hashing involves making a fingerprint of the data elements (a resulting formula made up of numbers and letters) in the transaction message. It is a viable means to check the validity of transactions, giving users the ability to instantly recognize whether someone or anything has messed with the data (Vermeend, 2017). While adding a new transaction to the network, a cryptographic test will be used to ensure that the users involved do not know who can confirm the transaction beforehand. Solving this problem is often referred to as "mining" and is carried out by representatives of the blockchain. Thus all computers present on the network are vying to validate the transaction (Vujičić,.Jagodić and Ranđić, 2018). When a block has reached or surpassed the full transaction hash capacity, prior blocks that completely form the network are queued (Blockchain.info, 2020).

### 2.3 Ethereum

Ethereum is a decentralised blockchain platform that establishes a peer-to-peer network that securely executes and verifies application code, called smart contracts. One of the major elements of ethereum is full turing-completeness, which means that it can support all types of computations such as loops. So Ethereum allows account status, as well as many other changes to the framework of the network. (Buterin, 2014). This is accomplished by the use of smart contracts which are coded rules that can be applied only if certain conditions are fulfilled (Buterin, 2016; Wohrer and Zdun, 2018). Consensus with the Ethereum network is based on the updated GHOST (Greedy Heaviest Observed Subtree) protocol (Sompolinsky and Zohar, 2015). This is designed to fix the network's issue of redundant blocks. GHOST protocol integrates such old blocks into the longest chain measurements. Ethereum's structure consists of accounts each with a 20-byte address and state changes. According to Sompolinsky and Zohar (2015) and Wood (2018), an Ethereum account is composed of four fields such as balance, contract code hash, storage root, and nonce. Ethereum embraces two types of accounts: proprietary based on private keys)and public based on their contract code (Vujičić,.Jagodić and Ranđić, 2018). Nonce represents the number of transactions made from a specified address or the number of contracts created from an account that is used as a promise that each transaction will only be completed once. Ether balance is the sum of Wei that this address contains (Wei is the smallest percentage of Ether; one Ether-ETH is equivalent to 1018 Wei). Ether is being used to make fees valid for the transmission.

### 2.4 Smart Contracts

Smart contracts are self-executing contracts with defined terms agreement between interested parties. The contracts are written in the form of software codes and are held in the blockchain network. Smart contracts allow transactions between private or untrusted parties to be carried out without the need for a central authority (Tapscott, 2016). Not only is it a computer process, it can be perceived as one of the contract partners, it can respond to the message it receives and store the details, it can also submit messages or values to the outside (Kosba, 2016).

In Ethereum, smart contracts are coded in higher-level languages and thereafter translated into an Ethereum Virtual Machine (EVM) bytecode. Those higher-level languages include Low-level Lisp-like Language (Chriseth, 2020), Serpent (the Python-like language) (ethereum / wiki, 2020), Viper (the Python-like language) (vyperlang / vyper, 2020), as well as Solidity (the Javascript-like language).

## 3. THE PROPOSED CHARITABLE SYSTEM

The system is web-based making use of (1) Node JS; (2) Next JS which is a React framework; (3) Semantic UI React and (4) Metamask. Node.js is a Javascript run-time environment that helps in the execution of JavaScript code server-side. It is an open-source cross-platform JavaScript that helps in the development of real-time network applications. It offers the developers event-driven I/O APIs and asynchronous. It can also interpret JavaScript code via Google's V8 JavaScript engine. While Next JS Next.js is also open-sourced with the advantage of providing ease of use as technologies such as webpack, react-router, react and react-dom are already configured on the go as well as code spitting and improve performance for index page loading. Semantic UI React on its side is a UI Component library implemented using a set of specifications designed around natural language. Semantic UI empowers designers and developers by creating a shared vocabulary for UI. Besides, the Metamask is an ETH wallet developed by the former Apple team. It combines Ethereum and Google Chrome in which users can operate Ethereum Dapps and identity recognition on Chrome. As a browser plugin, Metamask creates the wallet in your local device and then connects to other knots on the blockchain. The private key is stored in the local computer but not inside the Metamask database. For this reason, users don't have to worry about asset loss caused by the attack on Metamask server. The first level architectural design is illustrated in Figure 3.

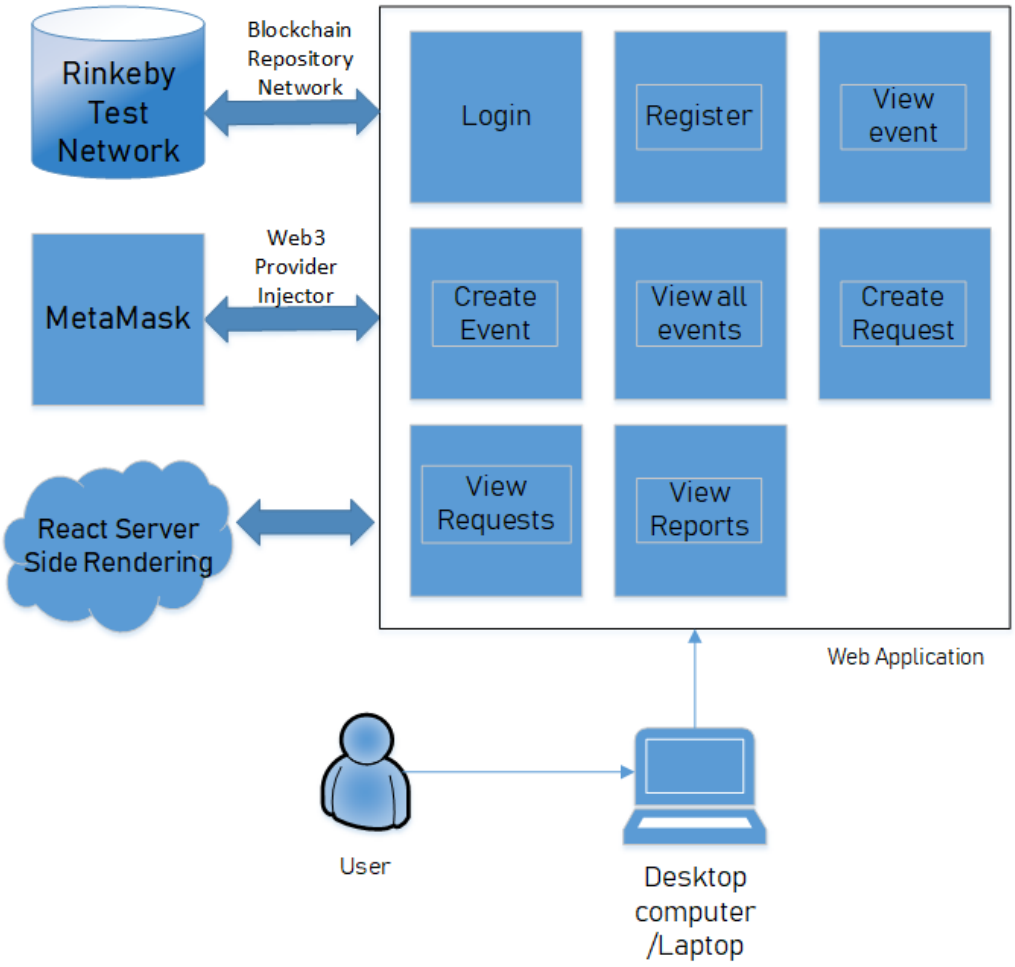



**Figure 3: Blockchain Architecture Design.**

The system allows managers of the system to create request, generate and validate event data, They have facilities on a dashboard to view donors' details including donations received monthly, generate reports about status and number of events created and approved. The donors on their side have a dashboard which enables them to submit their donations, follow events and even address queries. The landing page implementation consists of a header that provides the "Home", "Events" and "Whitepaper" functions to the general public as well as a "Donate Now" button which overlays the Login page. The contents of the landing page each redirect to the corresponding functions similar as the ones in the header. There is also a footer that provides the main links to the users as shown in Figure 3.

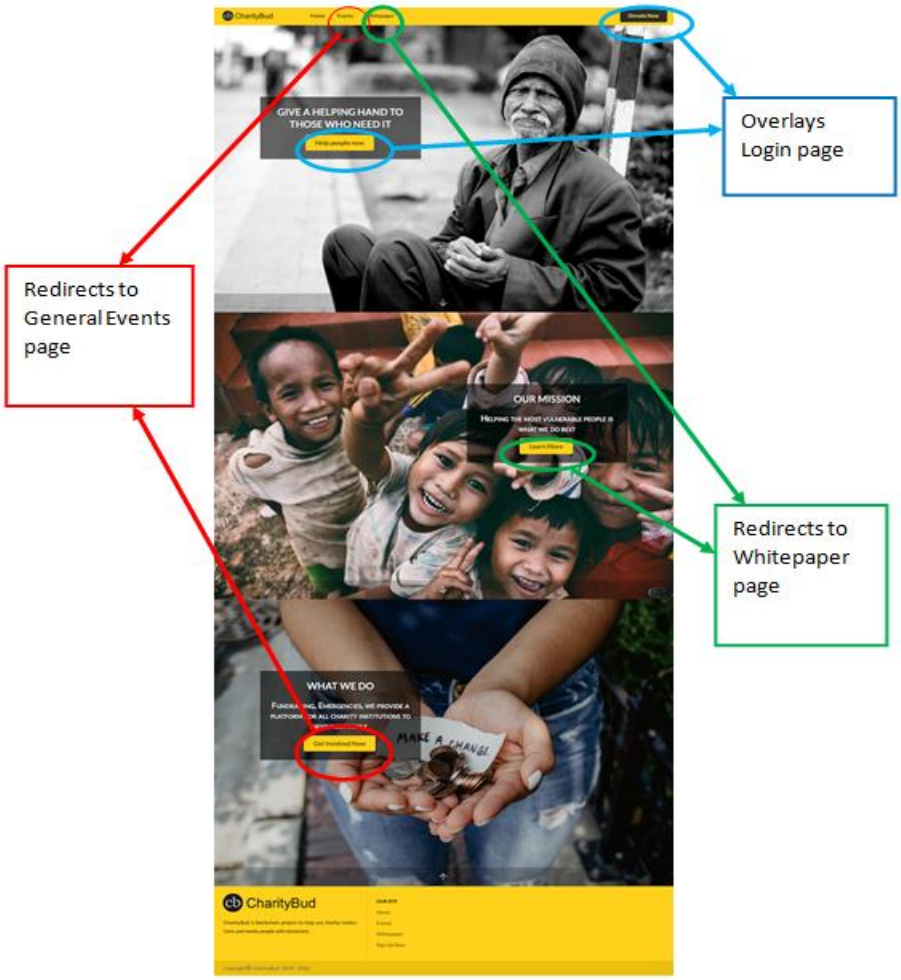



**Figure 4: Landing page.**

Besides, the manager dashboard shows statistics about the events being supported by the organisation with details such as the total amount of money collected by the organisation, number of events supported by the organisations and the number of people that have donated to the organisation as shown in Figure 5.

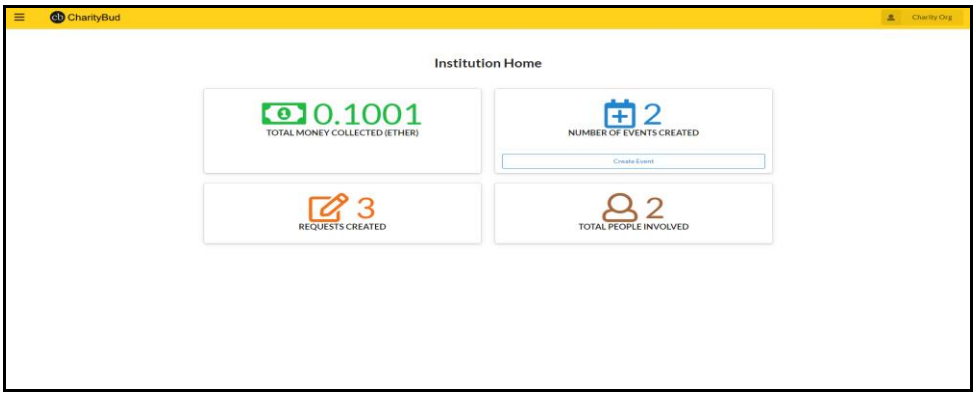



**Figure 5: Manager's Dashboard.**

Metamask is being used as the authentication platform to include the user's crypto wallet; on entering the website the Metamask automatically pops up and asks for the user's password for authentication as shown in Figure 6. MetaMask provides a cryptocurrency token wallet with a key vault and secure login for managing one's digital assets. It provides users with high security and connects to blockchain networks easier. As such, it is called to handle most of the transactions in the system based on the smart contract's criteria, hence providing a good level of security to the donor.

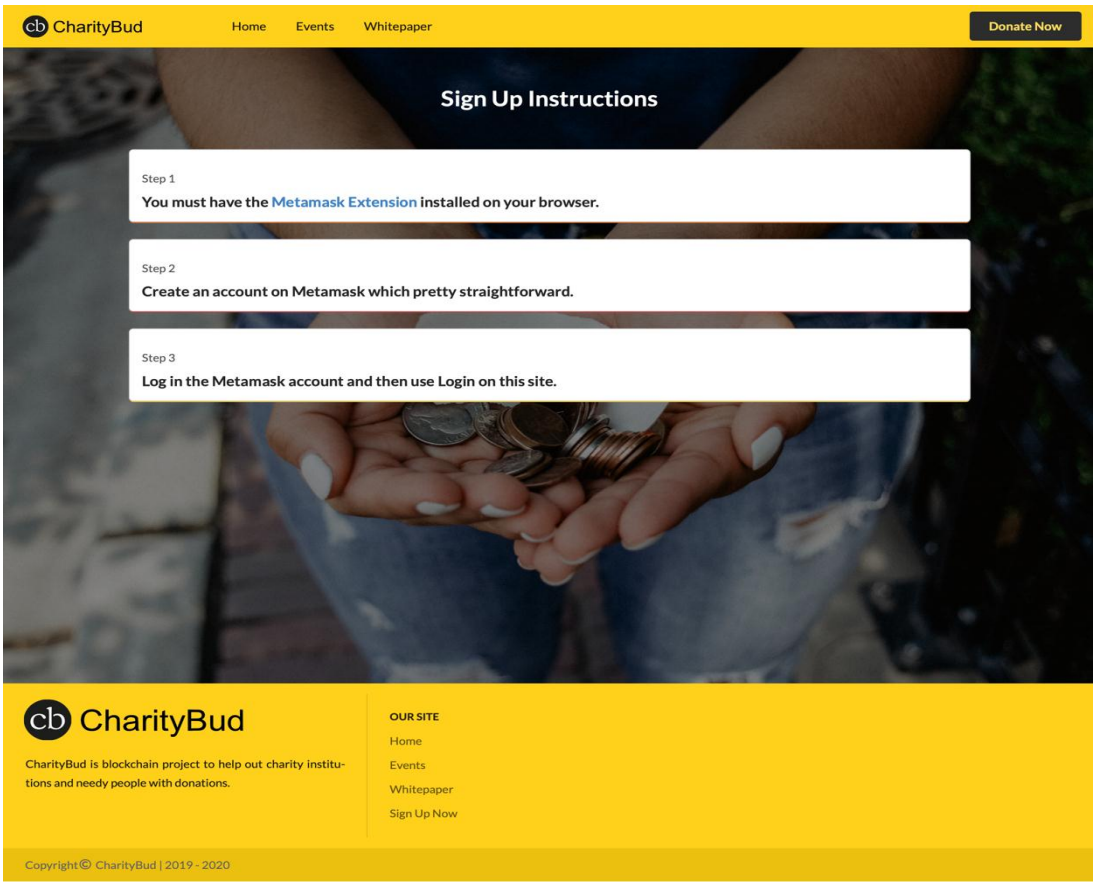



**Figure 6: Sign in/Sign Up Page.**

## 4. CONCLUSION

The main goal of the system has been achieved allowing charitable institutions to manage their charity events and help to raise funds securely and transparently. The Dashboard provides the event managers to have a clear view about the progress of the events being held such as money that has been raised, the expenditures pending to be approved by the donors, and also other events that have been created by other charity organisations present on the platform. Requests bring transparency in the spending of money raised through events created on the system where donors can have a say about the validity of the people receiving

the money and also the trustworthiness of the organisation. The Approval feature helps to bring consensus about the validity of an event by making people donate a minimum amount of money to have their say in the way that money is being spent within the organisations to people in need and the report generator is seen to facilitate the event manager to display the progress made by the organisation's event through a PDF file. In terms of security, the blockchain network: bring an immutable record of transactions from which all the details about donations and requests are kept safely. While the whitepaper provides an authoritative document or guide that quickly brings readers up on a complicated topic and introduces the ideology of the issuing body on the subject. It's meant to help people grasp an issue, address a conundrum, or make a decision. It also helps users to make the most of the system by laying out all the possibilities of the system.

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