BLOCKCHAIN PRACTICES

#BLING #UseCase #smartcontracts

Connecting Virtual Blockchains with Real Places

University of Edinburgh

GeoPact

Data driven innovation is transforming society and the economy. The Institute for Design Informatics at the University of Edinburgh designs systems for better human/data interaction, in diverse sectors including health, culture, mobility and finance. Design Informatics explores design from, with, and by data: focusing on the design of flows of data which sustain and enhance human values. Design Informatics are investigating the internet of things, blockchains, robotics, speech recognition, data visualisation, interaction design, and social computing.

Dr Dave Murray-Rust (now at TU Delft) is a Lecturer whose research focuses on the "interesting messy bits" between people and computational systems, from large scale Social Machines through the Internet of Things, to personal data and privacy. **Dr Ella Tallyn** is a Research Associate focusing on human/computer interfaces and understanding interactions between humans and autonomous systems.

Making technology accessible

New technologies such as blockchain and smart contracts are becoming increasingly widespread, running in the background and supporting finance and distribution transactions. As these technologies remain in the background, and people have little obvious interaction with them, our awareness of them is often provided through technological narratives and stories – such as in the media. This lack of awareness and understanding of these technologies prevents a more informed conversation around the implications and potential of these tools, particularly when organisations attempt to involve people in the design process as they create/improve services. This makes involving non-specialists in the design of applications that

FOLLOW US

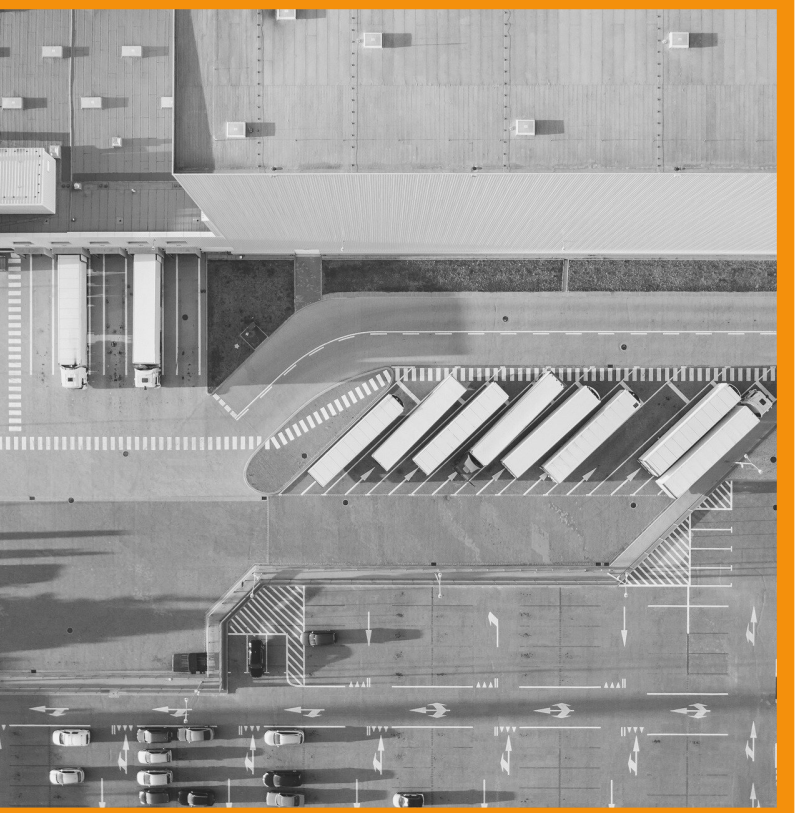
Interreg North Sea Region BLING
European Regional Development Fund
EUROPEAN UNION

BLOCKCHAIN PRACTICES

#BLING #UseCase
#locationbased #smartcontracts

employ these technologies challenging. In order to understand the effects these technologies may have on everyday lives, researchers are looking into ways to make them more accessible and understandable for non-specialist audiences.

Human-computer interaction (HCI) and design projects that collaborate with stakeholders and users to explore blockchain have worked with abstracted and simplified versions of their structures and applications using symbols - like Lego or cards. These methods allow researchers to focus on specific aspects/attributes of blockchains, without overloading people with technological concepts. Design Informatics' previous GeoCoin pilot gave users a real-world experience of location-based smart contracts supported by a mobile application – just by walking around the city. Roleplay and participation are effective tools to explain smart contracts.



Introducing GeoPact

GeoPact is a blockchain-backed location verification system which collects and confirms location data from smart objects with certainty and security. Users and organisations can then leverage this data through 'smart contracts' – self-executing computer protocols that run on a blockchain. Smart contracts are enabled by blockchains, as blockchain systems now include a programming language that can be used to create smart contracts. These smart contracts are agreements between two or more parties that can be automatically enacted by the blockchain's programming when a set of pre-agreed conditions are met - such as to transfer money, or to open a lock. GeoPact is both a proof of concept – illustrating how to link virtual and physical systems – and a real-world demonstration tool, which participants use to help them understand the potential of this technology and which helps make these virtual systems 'real'.

Design Informatics developed GeoPact as a platform to allow researchers and designers to work with people to help them understand and design location based smart contracts. Location-based smart contracts - computer code on a blockchain that allows the correct location of smart objects to trigger useful actions - provide a mechanism to exemplify the use of these new technologies in regular, everyday situations.

Enabling transport innovation

Designing for change in transport and logistics infrastructures is challenging. With more people than ever on the move, and the impact of growing volumes of home deliveries on urban logistics, this is an area that urgently needs design innovation.

Through trusted distributed structures and cryptographic data processing, distributed ledger technologies such as blockchain present opportunities to develop new systems and services

BLOCKCHAIN PRACTICES

#BLING #UseCase
#transportinnovation

locally and on a smaller scale. Smart contracts have the potential to provide a secure, programmatic method to enable people, objects and spaces to interact without the need for trusted third parties.

Using a fusion of location-based Internet of Things and blockchain technology to verify and secure location data, the GeoPact pilots explored how people, organisations and existing services could collaborate in developing new services that use location data as part of their transactions. Delivering this vision however needs tools and approaches which 'open up' these technologies - and their impact on transportation and logistics to society.

Blockchain and smart objects

GeoPact uses blockchain - digital ledger technology - to verify and secure location data used by 'smart objects' in the transport and delivery sector. Blockchains are systems that can computationally verify and store information in a decentralised network. Blockchains allow consensus to be achieved in a distributed system without requiring a central authority - this is important for applications that verify and permanently record transactions and data.

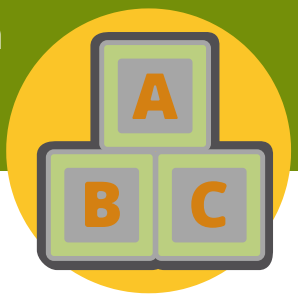
Design Informatics can see a future where the vehicles, street signs, and systems that manage traffic flow may all be 'smart', as part of an effort to create new systems and services that improve transport efficiency and ease congestion. Tools like GeoPact will underpin these services, ensuring that smart objects are where they say they are, managing this using approaches that make sure that location tracking and monitoring don't invade user privacy.

GeoPact uses a minimal disclosure approach, in which only the necessary information is disclosed in order to perform a transaction. This is a different approach from many other platforms – such as social media and Google in particular – that offer services which harvest user data that is not needed for service delivery.

There are already numerous ways of detecting the location of smart objects, for example through the location data provided by mobile phone networks. However, location reporting that uses these technologies can easily be faked, so they cannot be relied on in situations that may present risks to safety, have legal implications, or have larger financial consequences. Having certainty around recorded location and journeys – through the use of blockchain - unlocks verified location data for use in a number of applications. This certainty is particularly useful for delivery services, where these sorts of systems could provide certainty in knowing that an important package has actually been delivered to your home.

BLOCKCHAIN PRACTICES

#BLING #UseCase #locationdata



From 'smart contracts' to 'location-aware smart contracts'

'Location aware' smart contracts connect real-life actions – identified by sensors connected to the Internet of Things – to blockchain technologies, tying events together to ensure things happen in a specified way. This provides contractual certainty around the events that should take place as part of a process. Yet much of their value lies in the security provided by their technological structures that are not apparent at surface level.

The main challenge of communicating the potential of smart contracts is a combination of the complexity of the underlying technology, and the lack of general understanding of some of the underlying concepts. Smart contracts often do not match the public's existing mental or legal models of how contracts work. It is not obvious to many how trust can be built up by distributed systems, or why blockchain transactions would become more trustable over time. Having a 'community' of nodes working together to validate transactions and decisions is a change from how existing legal/dispute systems work. With GeoPact organisations can create different smart contracts specifying a wide range of terms and models of operation using location data.

GeoPact at work

The technological architecture of GeoPact integrates IoT technologies (LoRa, Bluetooth) with an Ethereum blockchain. Bluetooth beacons communicate across local networks using location data to confirm the identity and location of smart objects, then encrypt the data and resulting processing, storing it on the tamperproof Ethereum blockchain. The stored data can then be verified and accessed by distributed networks, and then used within smart contracts. In the face-to face GeoPact demonstrations participants work with both the infrastructure – IoT beacons, smart contracts and blockchain data – and the smart objects that participants interact with.

The GeoPact pilot enables people and things to transact and interact through secure, location-aware smart contracts. It provides a view into the concepts of a smart contract system, using transportation and logistics examples as a way to link them to real-life experiences. GeoPact participants go step by step through examples of functioning location-aware smart contracts, enabling them to experience some of the possible transactions a user might have while using the system, and in the process demystifying these technologies.

The GeoPact testbed combines smart lockboxes (used to securely transport items), electric scooters (which help us start to think about how future intelligent transport systems might work), Bluetooth beacons (providing location detection), and a Geoserver/Ethereum blockchain network provide the backend. A set of pre-coded location-aware smart contracts, which allow simple logic statements to be chained together (such as: 'if this box and this person are in the same place, the box will unlock'), govern events that must take place for the contract to complete. A dashboard displays an entire, active smart contract broken down into its constituent steps, along with a view of the data being written to the blockchain.

BLOCKCHAIN PRACTICES

#BLING #smartcontracts

The GeoPact demonstration suite was exhibited at three different locations in the spring of 2019. When Design Informatics delivered the GeoPact pilots they found that participants needed a clearly described scenario in order to grasp the complexity of the technology that was driving it. Building the pilot around a relatable scenario helped to show how the tools and concepts might transfer to real-life activities, and demystified the abstract concepts underlying these technologies. While getting participants to follow a pre-defined, guided set of interactions may sound like a counter-intuitive way to support creative thinking; Design Informatics found that it enabled participants to focus on the interactions and the resulting reactions (or non-reaction!) of the location-based smart contracts.

It was particularly helpful to provide two different views into the system: an overview via the dashboard that enabled participants to spectate and get a sense of the experience as a whole, plus the physical process of the delivery task with the boxes, interacting directly with the smart contracts. By providing a working example of how these innovative technologies might be used in practice, GeoPact gives participants confidence to comment on the potential real-world impact of the new types of applications that are enabled by blockchain.

GeoPact on the go

Following this trial, Design Informatics has now completed a second pilot trial with a revised GeoPact test suite that now uses a GeoPact phone app, and a new more robust, smart lockbox. These developments make GeoPact a more durable and accessible system - the phone app enabled GeoPact to work over mobile networks and over longer distances. This pilot explored the potential impact of GeoPact on last mile logistics and on courier work in particular. Initial analysis of the results from the trial look positive and suggest that there may be a feasible use case for location-aware smart contracts in last mile logistics. The results also show many possible directions for further developments.