Shareish (Share & Cherish): an open-source, map-based, web platform to foster mutual aid

Adrien Guilliams
Montefiore Institute (Dept. EE & CS),
University of Liège
Liège, Belgium

Ulysse Rubens
Montefiore Institute (Dept. EE & CS),
University of Liège
Liège, Belgium

Florent Banneux
Haute École de la Province de Liège
Seraing, Belgium

Pierre Chapeau
Montefiore Institute (Dept. EE & CS),
University of Liège
Liège, Belgium

Raphaël Marée
Montefiore Institute (Dept. EE & CS),
University of Liège
Liège, Belgium
Raphael.Maree@uliege.be

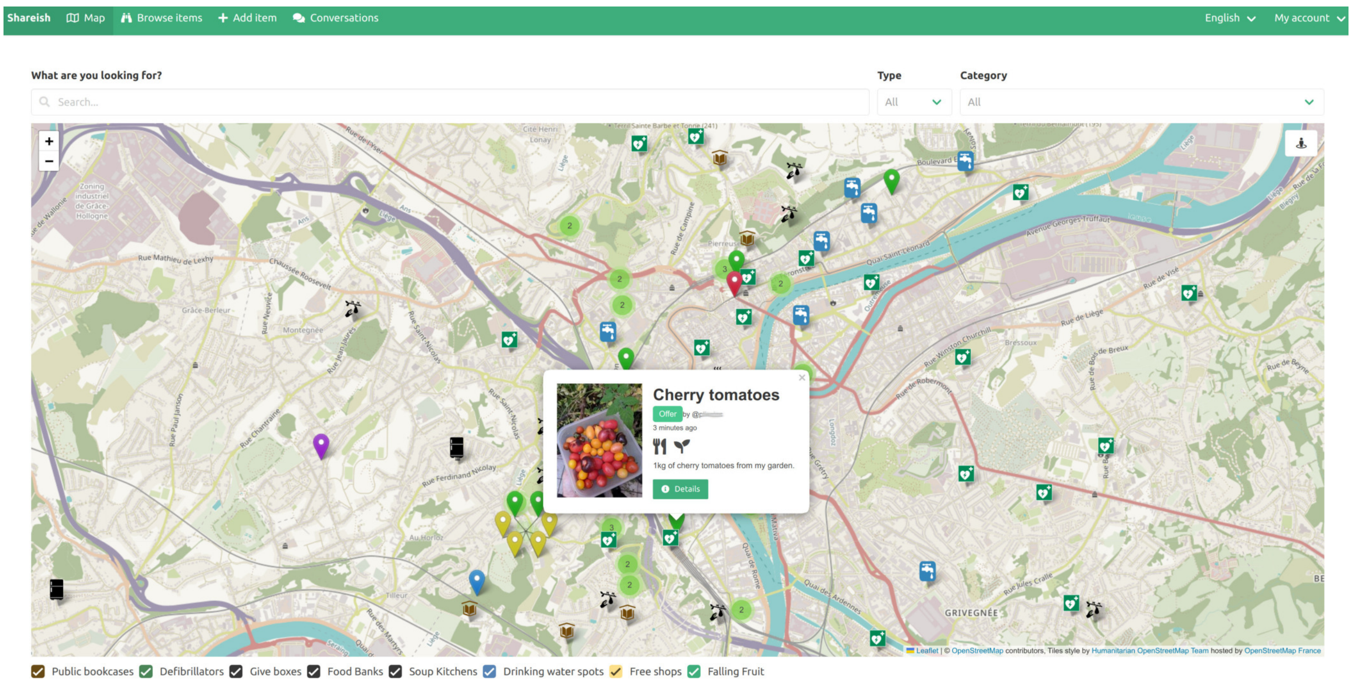

Figure 1: Shareish interactive map for the generalized exchange of geolocated, free, goods and services. Current location (blue marker), green markers (donation), yellow markers (free loan), red markers (requests), purple markers (events), and additional free public resources (public bookcases, falling fruits, give boxes, ...). In the center, a popup anchored to the map with a picture of a specific item (cherry tomatoes) to be offered by a specific user.

ABSTRACT

In this paper, we introduce the Shareish web platform to foster mutual aid following principles of gift economy and generalized exchange. Its design is grounded in prior work (in C&T, CSCW, and solidarity HCI) and it aims at leveraging community assets through donation, free loan, requests of goods and services, and free event announcements. Authenticated users can visualize localized items on a map or through lists, search with filters, add new content with rich textual and visual descriptions, discuss about specific content with others users, and get notifications when new content is created in their neighborhood. In addition, we evaluate AI technologies to ease content creation. The platform can be easily replicated and improved by grassroots movements or researchers seeking autonomy as its source code is made freely available and its installation relies on modern deployment strategies. A demonstration server is available (https://shareish.org/, see Section Online Resources).

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CCS CONCEPTS

• **Information systems** → **Web applications**; **Social networking sites**; • **Human-centered computing** → **Open source software**; • **Computing methodologies** → *Machine learning*.

KEYWORDS

mutual aid, generalized exchange, community economy, human needs, autonomy, community map, open-source, interactive map, online web application, free software, solidarity HCI

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1 INTRODUCTION

1.1 Context

In modern market-based economy, consumers visits commercial websites to purchase new products or to order services from suppliers. New objects can be bought from anywhere and cross continents to be delivered at home, requiring a few clicks only. Even food can be ordered online and travel miles to be delivered. While all of these commercial transactions are facilitated by technological platforms, we live in a world of global population growth, resource depletion, and unequal access to resources on the one hand, and of massive pollution and waste on the other. For instance, 17 percent of total global food production may be wasted [70]. Similarly, the impact of textile production and waste on the environment (e.g. due to "fast fashion" [49]) is significant [66]. Various global and local efforts are conducted to reduce or reorganise how we produce and consume (such as in the "circular economy" or "zero-waste" initiatives) but the societal organization of production, redistribution, and consumption should probably be further improved. There are many potential transformative and emancipatory alternatives with respect to environmental issues and solidarity [17, 37, 93].

At the beginning of the 21st century around the time of the Great Recession (2008), the rise of digital technologies and of the Web promised to help people cooperate and co-use their existing resources through the sharing economy where individuals grant each other temporary access to under-utilized physical assets (leveraging the "idling capacity"). Indeed, similar objects to those that can be purchased new might be underutilized by neighbours who acquired them previously. In a relatively comparable way, in the not-for-profit field, it is not uncommon for an organization to own a specific equipment that it under-utilizes while other organizations struggle to find such equipment for a one-time event. Similarly, this latter organization might have another equipment that would be useful for the former entity. In terms of food, stores or neighbours might have surpluses e.g. when the purchase or use of food does not go as planned, or when personal production of fruits, plants or vegetables is abundant. More than ten years after the onset of the digital sharing economy [55], it is obvious that social networks and such sharing platforms significantly ease the sale of (used) objects (e.g., via Facebook Marketplace or Vinted), the renting of physical assets (e.g. apartments through Airbnb or various tools through the Library of Things) or the access to various paid services (e.g. rent a scooter or taxi driver through Uber). Although these web platforms are undoubtedly useful for people who can afford to pay for sold items and services, these online tools do not profoundly change the way we produce, consume, and organize social relations. For example, according to a critical assessment of the sharing economy in Europe [11], food supply through existing ICT sharing platforms (e.g. to use food surplus) "hide from consumers negative outcomes such as precarious jobs, unfair labour practices, generating over-consumption, and hiding ecological externalities". In fact, many existing sharing platforms promote commercial transactions [5] and it seems that the interactions facilitated by technical and design choices of these systems are only a variant of the market-based economy principles [52]. These platforms have been very apt at "sharewashing" [30] or adopting and exploiting the language of non-monetary practices by transforming these interactions into for-profit business. In parallel, recent tragic events (such as a flood, war, pandemic, storm, economic crisis or recession, ...) have reminded us, on the one hand, that many people are vulnerable. On the other hand, the impulses of solidarity can be numerous but efficient organization of solidarity actions is essential [51, 85].

1.2 Local exchange trading systems, timebanks, and mutual aid

A potentially interesting way to reduce global waste and promote self-organization and solidarity is to place more emphasis on non-market-based methods of supply through local production and exchanges of goods and services directly between people. In the off-line world, local exchange trading systems (LETS) and timebanks are networks of individuals willing to share local goods and services using alternative or complementary currencies [61, 78]. There are plenty of such off-line initiatives in various regions of the world. While being very useful for involved individuals, these initiatives remain fairly minority in the sense that they concern a small number of people and available resources are not well-known to the general public. Potential free goods and services might be completely invisible to receivers and not shared by donors if these people are not involved in these off-line networks. Technologies supporting the redistribution of material resources and online interactive systems that make things for gifting or sharing more visible and efficient could be valuable [10, 45, 80]. There are some online interactive systems with the aim to facilitate exchange of goods and services but they have several drawbacks and limitations. First, some of these online platforms have specific geographical target audience (e.g. a city or a country) because they are managed by a single entity (a company or organization) which has limited resources. Therefore, many communities are not the target audience of those platforms hence many people are left out without the possibility to easily exchange with other people within their neighbourhood. Furthermore, these platforms are often using a "virtual currency" so that when a user offers an item (good or service) they can later use these money units they earned to barter, i.e. to later request a service or a good from others. However, such bartering (called pseudo-sharing in [5]) can potentially lead to exchanges motivated by accumulation and speculation hence somehow result in unequal access to resources, as goods and services are still exchanged for value received. Importantly, the use of a (virtual) currrency might also sometimes dissuade people from participating. As the determination of the value of a good or service is not obvious and depends on many factors, this can complicate and limit exchanges. In addition, individuals do not necessarily know at any time what they can give back. Therefore, bartering could dissuade especially those in need who currently have nothing to give back. Furthermore, bartering or timebanking does not sound ethical nor desirable in the aforementioned acute crisis situations, and one might argue quantifying and monetizing voluntary action somehow eliminates its autonomous aspects by denying to people the possibility to give altruistically [91] or by discouraging them from performing random acts of kindness [7] which generally have positive impact for all involved parties [16, 40]. It can also be argued these systems somehow maintain the societal status quo (perpetuate exploitation) by not profoundly redefining work and value [92]. In this context, Solidarity HCI researchers suggest novel tools should be created to move from a market logic to the co-creation of human economies [89]. In parallel, social researchers are calling for alternative paradigms that allow people to better meet their needs through cooperation or mutual aid, i.e. "solidarity not charity" [81].

While cooperation practices among strangers have been hypothesized to have declined over the last decades, there are reasons to remain optimistic [96]. As reported by various authors [12, 28, 39, 54, 74, 87], mutual aid, gifting, generalized exchange, and indirect reciprocity are ancient practices in the history of humanity which have persisted to varying degrees through the ages. When gifting, one does not negotiate an immediate return. Gifting or generalized reciprocity is the exchange of goods and services without keeping track of their exact value, with low obligation to reciprocate (with an eventual, implicit, expectation that their value will somehow balance out over time) or no obligation to reciprocate at all. While in bartering or in direct reciprocity, parties directly exchange resources with each other (two actors A and B give benefits to each other in a relation of direct reciprocity: A gives to B, and B gives to A), indirect generalized exchange involves more than two parties: One actor A gives benefits to another B and eventually receives benefits from a third party (C or D or ...) [56]. Another way to present this paradigm is to imagine a common place or platform (or "free shop") where everyone comes to deposit and draw items (goods or services), with the assumption we all have both needs and something to offer. Such generalized indirect exchanges are used for community cohesion through structuring social reciprocity, and they leverage community assets. Mutual aid has been a longstanding practice among communities who experience short-term and long-term crisis, and it is considered as a humanizing approach to care and a compassionate act based on shared humanity [46].

Recently, some features of the popular social media platforms (e.g. Facebook groups or Google Sheets) have been extensively used for mutual aid in acute crisis situations [36, 77, 85, 90]. While their use was instrumental by contributing to fill gaps in essential supplies and services left unfilled by the State, these platforms have several drawbacks. Their design lead to time-consuming and laborious work (e.g. scrolling through a group's Facebook timeline to find aid requester's or providers' posts), as reported in [36]. They are also not exploiting geolocalizations whereas community maps can better raise consciousness and produce forms of empowerment [65]. While access to earlier geographic information systems was a concern [15, 79], modern online maps are now often considered as an ideal interactive, mobile, and collaborative interface between a human, groups of people and the dynamically evolving environment [38]. Online maps enable users to better engage with reality as discussed in [2, 32] for emergency/disaster management where it is suggested data should be displayed by geographic location on maps in relation to the user's current position, rather than as item lists (e.g. posts on a Facebook Group's feed). Moreover, aforementioned commercial platforms (and others, such as Nextdoor) create individual and collective tensions including political conflictuality and practical powerlessness [53, 67, 73]. Political tensions include the fact the platforms that underlie so much of our daily lives and social interactions are controlled by a small group of owners who remain largely unaccountable for their decisions [23, 60]. Practical powerlessness relates to the fact their source code is proprietary (not accessible), so these platforms can not be finely community-controlled but only managed by an external entity. In practice, proprietary platforms cannot be easily scrutinized or extended by their actual users or by researchers to fit their specific needs. For example, it is not well-known how posts in a Facebook group's feed are ordered, and neither software developers nor aid providers can change this ordering according to practical considerations. Pragmatic design tensions [73] also encompass the absence of guarantee an existing, useful, feature will remain available or affordable. In practice, it is not uncommon that a single entity managing a dedicated platform decides to discontinue it, or to reorient its objectives or features for commercial reasons. [1] In contrast, open-source distribution means the whole recipe of a software platform (its source code) will remain available and readable, so the suite of operations behind each software feature can be scrutinized and modified. It allows its reuse by various communities (including less-resourced grassroots groups) and the seamless launch of bottom up initiatives rooted in daily lives. Open-source technologies are expected to increase human autonomy by enabling the creation of autonomous spaces adapted to local conditions and not subjected to a centralised control, hence reclaiming a greater human dignity [35, 83].

1.3 This work: mutual aid meets online community mapping and open-source practice

Our aim is to offer a user-friendly web environment to people driven by mutual trust, comradeship, and generosity and refusing to measure and remember who had given what to whom, to increase random acts of kindness and more broadly solidarity practices at the street corner or beyond while improving their efficiency. Towards that goal, we present Shareish ("Share and Cherish"), a modern web platform with an interactive map and advanced search functions that can be easily deployed to foster mutual aid by enabling generalized exchange of geolocated, goods and services. After all,

[1] E.g. the Jaspr Trades for "cash-free swap community in Berlin" suddenly ended its activity, the renting platform Usitoo in Belgium did not find a sustainable business model and was discontinued, the Kassi online forum "with the aim of linking those who can give something to those who are in need" [41] became as a start-up company the "Sharetribe online marketplace to sell, buy, and lend stuff", …

technological tools are massively used by citizens e.g. to localize and use electric scooters in large cities, so there is no technical reason that this cannot be the case to easily access other free resources while promoting solidarity and reuse. The whole system is distributed under an open-source permissive license as a gift to the society, and to foster further developments by C&T and CSCW developers. From a computer science perspective, this work is at the intersection of human-centered informatics, modern web/software development, spatial database design, and container technologies. In addition, Shareish exploits recent research in deep learning to ease user experience.

In Section 2, we first present our design methodology and the technical choices underlying the development of this platform. In Section 3, we report on the early usage of the platform and provide screenshots of the user interfaces and experimental data related to an actual deployment. Then, we discuss limitations and perspectives in Section 4. Finally, we conclude.

2 GENERAL DESIGN AND IMPLEMENTATION

2.1 Design methodology and requirements

Designing an online platform for computer-mediated mutual aid necessitated learning about the needs, practices, and problems of the intended users. To this end, we relied on multiple data sources and initiatives: Research papers that have thoroughly analyzed the content of mutual aid groups created during the COVID-19 pandemic with tens of thousands of requests/aids [36, 77, 85, 90]; papers that have retrospectively analyzed thousands of transactions in Timebanks or online forums for local communities [14, 27, 29, 47]; previous C&T, CSCW, and HCI research works that relates to the design of community/sharing platforms in a human-centered way [6, 7, 18–22, 32, 36, 41, 42, 44, 50, 62, 82, 95] and whose authors have derived design guidelines and implications (through case studies, interviews, and participatory design workshops); data from a city-wide "donation" Facebook group with more than 40K users (200 posts randomly sampled over a period of three months in 2022); data from a specific, closed-source, web platform (https://aide-inondations.be/) created following a major flood in Belgium (100 random posts randomly sampled over a period of one month following the tragic event in 2021). We also created accounts for examination on https://vinted.com/ (a commercial platform for secondhand items), Facebook Marketplace (https://www.facebook.com/marketplace), Mytroc https://mytroc.fr (a LETS platform using a virtual currency), and on https://www.freecycle.org/ (a bulletin board for donations and requests). Furthermore, we analyzed SolidarityCityMap (https://solidary.city/) and Priceless (https://priceless.zottelig.ch/), two maps that show places where people can participate in city life without papers or money; as well as two applications to update OpenStreetMap database content (https://www.openstreetmap.org/, the free editable map of the world): StreetComplete (https://streetcomplete.app/) and MapComplete (https://mapcomplete.osm.be/).

This large body of previous works allowed us to derive initial requirements. A first iteration of our prototype has been implemented and deployed on a demonstration server (https://shareish.org/). During a 6 months testing period, invitations were sent to 95 individuals through social media channels. Among them, 18 users (outside of our development team, all from Liège in Belgium) have created an account and tested the main features of the platform. They have a variety of experiences (with off-line local exchange systems, modern social media, and commercial sharing platforms), diverse occupations (incl. software engineer, high school teacher, visual/sound artist, unemployed, retired), and participation is gender-balanced. We followed an iterative design, development, and development cycle to refine the requirements and the corresponding software implementation. Over this period and based on user's feedback, significant changes have been made to the initial prototype through approximately 150 commits (changes to the source code to implement new features, bug fixes, style changes, ...). These changes have been continuously deployed on the demonstration server so that end-users were able to test different versions (iterations) of the platform. It is therefore a combination of previous research work and this iterative user-centred process that has allowed us to derive the design summarized below. These general design requirements are translated into software functionalities in Section 2.2 and their technical implementation is described in Section 2.3.

Reqt 1 Ease of access & use: The platform should be accessible on both personal computers and mobile phones [19], take into account the community diversity (incl. multilingualism); provide various hints and helping functions.

Reqt 2 Locally situated: the platform should provide a strong connection to geographic location to foster a sense of community within a hyperlocal environment [82] and allow participants to mobilize resources from their local communities [47], while taking into account people's ever-changing location [7] and residential instability [48], so without rigid assignment of users to a neighborhood [53, 67]. An online interactive map is considered the most useful tool to find shared objects within or beyond users' immediate neighborhood [21], and it is strongly advised for managing tasks in emergency situations [2, 32].

Reqt 3 Solidarity through generalized exchange: The platform should allow individuals to satisfy basic needs first [6] while also mitigating their potential feeling of indebtness [41]. The platform should make it just as easy to offer, lend (for free) or ask for help, so that individuals or entities can switch between roles and create value together [10]. To allow wide participation across the community, it should provide *open* access to basic, freely available tangible goods, services, and events. According to previous studies [14, 27, 29, 36, 47, 51, 77, 85, 90] and our data analysis, users should be able to offer/seek a wide variety of time-sensitive items (goods & services) e.g. (cooked or raw) food, clothes and blankets, pick-up of essential materials, drop off of groceries, transportation to medical appointments, HVAC equipments (air conditioners, dehumidifiers, heating systems), helping hands for a move or cleaning, assistance with administrative tasks; as well as announcing activities, ...

Reqt 4 Fine-grained content information: Providers (resp. receivers) should be able to precisely describe a great variety of goods and services they are providing (resp. seeking) rather than only through generic categories that are insufficient in the details they convey [21]. Clear time limits must be definable to minimize efforts required to manage posted content [42].

Reqt 5 Efficient user content creation: The platform should provide various auto-completion mechanisms to help users to easily add structured content [21, 36] in order to create active-enough streams of content [48]. This might be facilitated by the reappropriation of emerging AI recognition technologies [84].

Reqt 6 Efficient content search and scalability: The platform should provide different ways for searching and visualizing items based on their location and various filtering criteria exploiting their rich descriptions, rather than laborious scrolling through an infinite list of posts without any control on how items are presented [36].

Reqt7 Continuous perception of activity: The platform should provide users information about site activity for building a sense of social presence [82] using mechanisms to display site usage, and configurable proximity notifications that indicate activity in the neighborhood (e.g. instantly when someone encounters an unexpected need [8] or posts a new offer; or only daily/weekly notifications) [20].

Reqt 8 Building user trust: The platform should provide mechanisms to build trust between potential exchange partners, e.g. to allow progressive self-disclosure to accentuate common interests between users (e.g. using profile with/without name and picture, with precise/approximate location, and through asynchronous or real-time dialogue) [19, 22, 36, 41, 64].

Reqt 9 Transparent data processing & privacy: The platform should provide ways to scrutinize how user's data are handled [53, 76].

Reqt10 IT Management: The platform should ease day-to-day organization [50] including modules for system administration (installation and maintenance), content curation, and data extraction. The platform should be easy to replicate so it can be reused and adapted for different places and communities [43, 79].

2.2 Shareish main functionalities

With Shareish, users (individuals or entities) can easily indicate they want to either give (Donation), loan (Loan), or ask for (Request) items, as well as announce Events. They can also easily discover what other users have to offer or what they request [Reqt 3], using various interactive mechanisms (a map [Reqt 2] and a browsable list with advanced filters [Reqt 6], configurable notifications of new content [Reqt 7], and textual conversations [Reqt 8]). Shareish user interfaces have been designed to make it easy to adapt to other languages (internationalization) [Reqt 1], and it is currently available in English and French.

2.2.1 Users. A Shareish user can be a provider or a receiver [Reqt 3]. In our data model, a *user* is typically an individual (but it might be a representative of an organization) to which a unique e-mail address has to be associated to register on the platform. In addition, the user can provide an additional textual description and links to other social networks, as well as a profile picture [Reqt 8]. In their profile, users can also indicate their reference address [Reqt 2] that can be used to get *notifications* (instantly, daily, or weekly) by e-mail when new content is published [Reqt 7] in a configurable neighboorhood (based on the *distance* as the crow flies [Reqt 2]).

2.2.2 Items. A user can add or search content on the platform. Each piece of content is called an *item* and it can be either a good (e.g. a mower to lent or to give), a service (e.g. to mow your lawn), or an event (e.g. a free Repair café, an assembly meeting) [Reqt 3]. More precisely, when a user adds an item, they have to choose an *item title*, an *item type* (Donation, Loan, Request, Event), and up to three *item categories* among a list of predefined categories that cover a large number of goods and services (Food and Supplies; Pets and Animals; Arts, Culture, and Entertainments; Collectibles and Decoratives; Helping hand and Manual Labor; Administrative tasks; Do-it-Yourself; Beauty and Well-being; Health; Energy and Heating; Childhood; Clothes and Shoes; IT and Multimedia Hardware; Informatics Software; Gardening and Nature; Living spaces and Housing; Tools and Equipments and Ustensils; Holidays, Weekend, Leisures; Books and Magazines; CDs, DVDs, Blu-rays, Discs; Sports; Transportation, Delivery, Pick-up, Moving; Vehicles and Means of transport; Other) [Reqt 3]. In addition to a *textual description*, *images* can be associated to an item so other users have access to precise information about it [Reqt 4]. Importantly, a physical *address* can be associated to an item [Reqt 2], hence each item can be displayed on an interactive map, so that other users can discover easily available items in their neighborhood (and be notified with approximate distance information [Reqt 7]). The address can be either very precise (including street name and number) or rather vague (city name), the choice being left to the user to reveal or not their item precise location [Reqt 8,9].

2.2.3 Auto-completion mechanisms and content management. Encoding item metadata might take a while and can be a barrier to the creation of new content. We provide several mechanisms to ease this process [Reqt 5]. First, the item address can be directly copied from current user location (provided they accept geolocalization through their browser settings). Moreover, once a user associates an image to their item, an auto-tagging workflow is executed. The first step uses a deep learning classification model that takes an item image as input and that outputs a term from a list of 1000 object classes. This term is then used to fill the title field of the item (e.g. tomatoes) and it is mapped automatically to one of the twenty Shareish categories (e.g. Food and Supplies) to auto-complete the category field. In addition, when the item image contains text, an OCR engine is used to recognize text and inserts the detected text into the description field of the item. We also evaluated the use of bar code recognition for books (see Section 2.3). All these pre-filled data can be manually edited. To further reduce manual encoding, a user can mark an item as recurrent to ease its resubmission. For example, if a user has an apple tree and they have too much apples at each harvest, they can encode an item called "apples" and make it recurrent so that the next time they will go to this recurrent item and repost the "apples" without the need to encode details again (similarly for recurrent requests e.g. weekly grocery delivery). The owner of an item can also delete it from the platform. To minimize efforts required to manage posted content, a start date and an end date can also be specified [Reqt 4], so that the item will automatically disappear after the end date. This can be used in multiple ways, e.g. to automatically delete past events or perishable items, or to request a service within a specific timeframe.

2.2.4 Interactive Map and List. By default, the interactive map and the listing-page show all items and are two complementary ways to access site content. While the interactive map allows to explore data based on geographical locations, the item list orders items by creation date (most recent first), with distance information as well as viewing counts [Reqt 7]. To ease discovery [Reqt 6], filters can be applied both on the map and on the item list, based on item type, item category, or based on textual search (the search is performed over all item titles and textual descriptions). In addition to user contributed items, it is also possible to display on the map free amenities including public bookcases, drinking water sources, defibrillators, give boxes, food banks, soup kitchens, free shops, and falling fruits. Users can activate or desactivate their display on the map. By combining filters and check-boxes on the map, users can directly access to relevant data in their current vicinity [Reqt 2,6].

2.2.5 Conversations. Shareish enables online communication between users in its "Conversations" module: For each item it is possible to start an online textual conversation between the provider and the receiver to get further details about the item, to get to know each other [Reqt 8], and ultimately to arrange an appointment for the exchange (e.g. to reveal the exact address and choose the time at which the exchange could take place). The first message of a conversation is automatically suggested based on the item type and can be further edited before being sent. Both UI and an e-mail mechanisms are used to notify users when they receive messages to foster activity, similarly to notifications for items and events.

2.3 Shareish technical implementation

Delivering these functionalities in a way that is effective for users requires modern and robust architecture and user interfaces compatible with a variety of user devices [Reqt 1]. The architecture of the platform is depicted by Figure 2. It follows a representational state transfer (REST) Client-Server architecture style that structures database resources and that standardizes communication interfaces. Our underlying data model is implemented using a spatial, relational database where we store data related to the aforementioned concepts of users, items, and conversations (see Figure 3). Concretely, our implementation is divided into two main parts: the front-end (client-side) and the back-end (server-side), described below. For each part we followed common practices in software development and use popular programming languages and libraries to facilitate its maintenance and reappropriation by other software developers.

2.3.1 Front-end. The front-end regroups all the code necessary for the web user interface and mainly revolves around VueJS (https://vuejs.org/), a modern Javascript framework for building modern, responsive, user interfaces. It is combined with Buefy (https://buefy.org/) that offers lightweight UI components, and Leaflet, a JavaScript library for web mapping applications. We use Vue I18n internationalization plugin to support translation to different languages and localization (such as datetime), and tooltips to provide online, contextual help. The generic map data is fetched from OpenStreetMap API. Map tiles are from the humanitarian map style (http://map.hotosm.org/) which is focused on resources useful for humanitarian organizations and citizens in general, highlighting POIs like light sources, public and social buildings, ... On top of the map tiles, we display anchor markers, one marker corresponding to one user-created item. We use the Verbatim API to map an item address (as encoded by its user) to its geographical coordinates. Markers are colorized according to their corresponding *item type* (green for a donation, yellow for a loan, red for a request, and purple for an event). Current user location is displayed as a blue marker. In addition to user-contributed items, it is possible to display on the map other public free resources (such as public bookcases, drinking water amenities, falling fruits, . . .) at their precise locations (as encoded in the OpenStreetMap or Falling Fruit databases) using markers with representative icons (from Wikimedia Commons).

As the number of markers can be potentially large (e.g. there are almost 1.5M falling fruit and 250K drinking water locations worldwide), markers are clustered thanks to the Leaflet Marker clustering plugin and displayed as one reach a certain zoom level in the map. Going over a marker shows essential information (such as the item image, its type, a short description, and creator) while clicking on it will show full details and let the user starts a conversation with its creator. In addition to the map, we also offer a "list view" of items with filters, following a listing-page design approach which loads content continuously as the user scrolls down (infinite scrolling). Similarly, users can get from there full item details and start conversations. In the Conversations tab, conversations are grouped by items and sorted by last message first.

2.3.2 Back-end. The back-end regroups everything that takes place on the server-side of the application. It relies on the Django framework written in the Python programming language. It describes how objects interact with each others (the "business logic" of the application) and it defines the methods to filter, add, update, and delete these objects. To save and retrieve data into and from the relational database, Django provides an ORM (object-relational mapper) library that provides means to interact with the database and convert objects within the Python programming language into relational data in the database, and vice versa. User-created items are obtained through API endpoints that implements filters on item categories (e.g. to retrieve only "Food" items), users (e.g. to retrieve only items created by a specific user), or title/description (e.g. to retrieve only items which have "cherry tomatoes" in their textual description). The API endpoint for items implements a pagination mechanism to enable progressive loading of large number of items, such as with infinite scrolling in the "browse items" front-end page. In addition to user contributed items, we call OverPass API to import OpenStreetMap data related to free amenities, and Falling Fruit API (https://fallingfruit.org/) to import free fruit locations. These external data sources are not explicitly stored in our database but retrieved (using current map location boundaries) from the official OSM and Falling Fruit databases, so they are always up-to-date.

The messaging system (Conversations) is implemented using WebSockets (via Django channels) so that each user's item conversation page will refresh automatically, without the user having to explicitly reload the browser.

2.3.3 Database model. We use a relational data model implemented using PostgreSQL (https://www.postgresql.org/). The data model

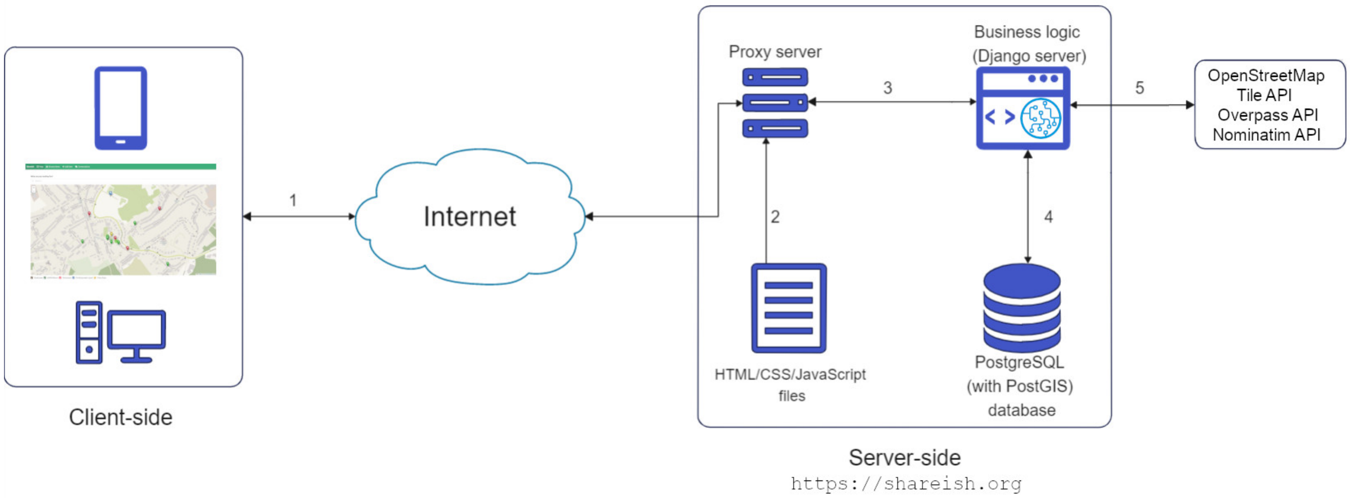

Figure 2: Overview of Shareish web architecture. Shareish can be accessed through various clients (web browser or mobile) which send requests to a Shareish server composed of three containers (proxy, web framework, database). The proxy server receives requests and redirects requests to the web container (Django framework) which handles the request and sends either SQL requests to the database container (PostGIS) to fill web pages with data user or item data, or requests to external APIs to load cartographic data, namely OpenStreetMap Tile API (to display map tiles), Nominatim API (to convert physical addresses to geographical coordinates), Overpass or Falling Fruit API (to display external data sources). The AI auto-tagging module is included in the web container.

determines the logical structure of our database where we store, organize, and manipulate data related to users, items, and conversations. We use PostGIS spatial extension (https://postgis.net/) to be able to perform operations on spatial coordinates, e.g. to compute the distance between current user position and an item. The distance is displayed in the item list, or used to notify users when a new item is created in their neighborhood. The Shareish data model is depicted by Figure 3.

2.3.4 Deep learning for item auto-tagging. We evaluated various approaches to ease manual encoding of item metadata based on user-provided item images. These images are transferred between the client-side and server-side of the application. Deep learning models and computer vision workflows are automatically triggered by the back-end once a contributor associates an image to describe an item.

The first approach uses a variant of a state-of-the-art deep learning model that we use to predict the title of the item and infer its category. More precisely, we use MobileNetV3_Large which is an optimized version of MobileNet in terms of accuracy as well as in terms of computational requirements [34]. Our choice of this model is justified by its published performances on ImageNet-1K benchmark and its fast execution time. Indeed, the goal is to speed-up the encoding of item's metadata so responsiveness is a critical factor. We used the pre-trained MobileNetV3_Large model that is available in the torchvision library (https://pytorch.org/hub/pytorch_vision_mobilenet_v2/) and that aims at categorizing an image among 1000 nouns of the WordNet hierarchy. The term predicted by the model is then mapped to one of the 20 Shareish categories to automatically fill the first item category field.

To further reduce manual encoding time, we envisioned to apply optical character recognition (OCR) techniques to detect textual elements in the uploaded item image hence auto-complete the item's description field. This can be particularly useful for detecting the title of cultural items (e.g. books) or any other equipment whose name is visible (e.g. a household appliance). We evaluated three approaches. The first algorithm is Tesseract (https://github.com/tesseract-ocr/tesseract), that relies on Long-Short-Term-Memory (LSTM) networks that have proved to be specially proficient in text recognition [33]. The second algorithm is CRAFT (https://github.com/clovaai/CRAFT-pytorch, Character Region Awareness for Text Detection) [4] that reaches state-of-the-art results for robust scene text detection in natural images including highly curved texts. The latest approach, pyzbar (https://pypi.org/project/pyzbar/) is a barcode recognition using a computer vision pipeline. Details of our experiments are given in Section 3.2.

Because these auto-tagging approaches are prone to error and anyway users might want to add additional information about their items, predicted metadata are transferred from the back-end into the editable UI forms of the front-end. Hence, only user validated content is stored in the database.

2.3.5 Security. We implemented several security mechanisms such as HTTPS protocol, back-end URLs that can only be accessed by identified users (users will need to confirm their registration via email prior to being able to log in to the site), permissions (e.g. conversations are only accessible to the two involved users), and cross-origin resource sharing.

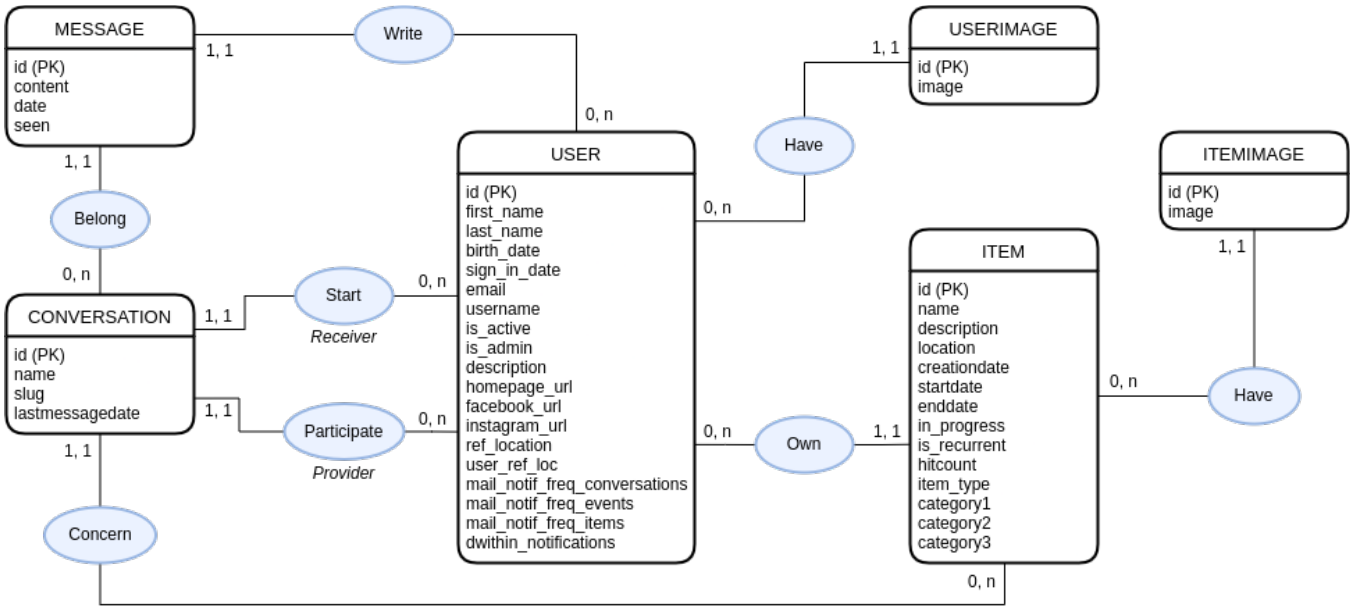

Figure 3: Overview of the Shareish relational data model with main entities: User, Item, and Conversation (all details are not shown for readability).

2.3.6 Deployment and database administration. As Shareish relies on various software technologies and because computing environments are heterogeneous (e.g. the server of a not-for-profit organization, the personal computer of an HCI developer, . . .), it is very important the design includes a reproducible, sustainable installation procedure to ease replication and updates of the platform [Reqt 10]. We use Docker Compose (https://www.docker.com/) container technology [97] to encapsulate the software components. It eases the deployment of current and future versions of the Shareish platform, in two modes: local development mode, or production mode. Local development mode eases iterative development with hot reload mechanisms that allow developers to change code locally and directly see their changes on the instance deployed on their personal computer. Organizations will use the production deployment mode where Docker technology is combined with nginx proxy server (https://nginx.org/) to install the platform on a server and make it available straightforwardly to intended users through a web browser or mobile phone [Reqt 1,10].

If necessary, database content of a Shareish instance can be managed by logging into the database container, or more conveniently by using Django admin module. This module reads Shareish data models and automatically provides a web user interface where trusted users (e.g. community moderators) can manage content [Reqt 9,10] using CRUD operations (create, read, update, and delete).

Overall, thanks to component-based and object-oriented programming practices, the platform source code is rather compact: the front-end is composed of a bit more than 5000 lines of code (including Vue and Javascript files), and the back-end has also about 5000 lines of code (mostly Python files). These numbers do not include the code of the many libraries we have integrated but only our own code. Shareish is standing on the shoulders of giants.

3 RESULTS

3.1 Actual server deployment, platform assessment, and front-end screenshots

As previously mentioned in Section 2.1, a Shareish demonstration instance has been successfully deployed on a server. In addition to our team members, it has been tested by 18 users living in Liège, a belgian city affected by severe floods in July 2021. Based on users' feedback, we iterated over the design that lead to Shareish v0.3 release (initial paper submission, available on our code repository). Thanks to the use of modern responsive design technologies, users have been able to successfully log in to and use the platform on various web browsers and mobile phones (Android, Windows, Linux, macOS, iOS). During the testing period, all users tested the main features of the platform (configuration of their account including notification parameters, exploration of the map, browsing of the item list, . . .), 6 users created a few real items they wanted to offer or request, and discussed about them using the conversation modules. Overall, end-users provided various feedback that were translated into previously described features. New features or improvements that were requested during latest test iterations reinforce design requirements. This includes the possibility to associate multiple images to user's items and profile (which reinforces [Reqt 4,8]), more advanced content search using a combination of multiple criteria (e.g. "unseen requests for help in a neighborhood of 10km published during the last 2 days, sorted by distance", [Reqt 6]), a more intuitive user interface for the conversation module with ordering and searching for messages [Reqt 6,8], and the use of different UI themes (e.g. dark theme). These additional features (except for the last) were implemented between initial paper submission and camera-ready paper submission (Shareish version v0.4 on our code repository) but are not described in this paper. Readers are invited to test the latest version (and future releases) deployed on our demonstration server (see Section Online Resources). Larger practical field tests and long-term case studies (e.g. similarly to [21]) should be the subject of future work to further assess the implementation in practice of the design requirements.

In addition to having been tested by end-users, the demonstration server was successfully used as a testbed to inject up to 10 000 artificial items to assess the scalability of the platform. Our architecture (including back-end database and front-end mechanisms such as chunked loading and clustering) was designed to scale and it is robust enough to display a large number of items efficiently. The resulting interactive Map page, the "browse items" listing-page, the page to add a new item with pre-filled category and description (by the auto-tagging module), the page to view details of an item, the page to view user conversations, and the page for setting notification parameters are illustrated by Figures 4 to 9.

The automatic installation procedure using container technologies takes about 10 minutes and includes automatic download of all libraries/modules, automatic build of front-end, back-end, and database container images. Then, the automatic procedure to start all the platform containers takes about 1 minute. The same installation procedure has been tested several times with different versions (iterations) of the platform and on 5 different servers/laptops of our team members to assess portability and reproducibility. Thanks to the use of technologies described in Section 2.3.6, the technological burden is significantly reduced [Reqt 10] with respect to traditional deployment techniques where many manual configurations have to be set to run such a platform on a new host server. In terms of software maintenance, third-party organizations will be able to install future versions of the platform by fetching latest source code from our centralized repository (see Online Resources). Then, the installation procedure will consist in automatically rebuilding container images and applying database migrations (while keeping user data) as these operations are configured to occur automatically on startup.

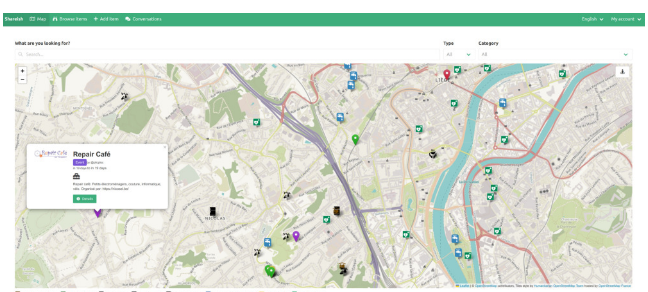

Figure 4: Shareish UI. Top: navigation bar with access to the map, the listing-page, the add item page, conversation space, and account settings. Main view: the Map where users can navigate (zoom in/out, pan, locate), filter items, and enable/disable external data sources related to public amenities (bottom).

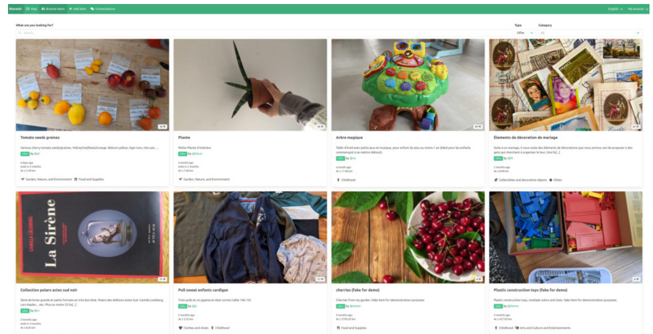

Figure 5: Shareish UI to browse items (listing-page). The list of items can be displayed according to the same search filters than on the Map page (here: Offers only). Each item card shows the item image, creator, type, time frame, and categories; as well as distance from current position.

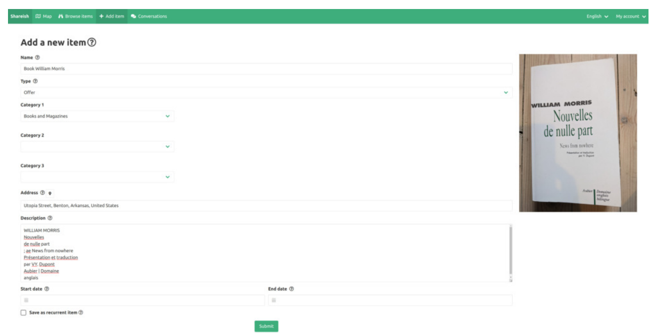

Figure 6: Shareish UI to add a new item. A picture of a book jacket is first uploaded by the user, with item Category and Description being automatically pre-filled using the back-end auto-tagging module. Then, the user can manually edit all fields before submitting the item to the platform.

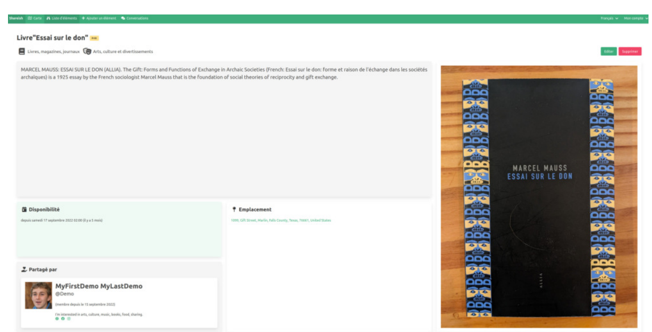

Figure 7: Shareish UI to view details of an item. The internationalization UI components allows to display the user interface in different languages and localization settings (illustrated here in French).

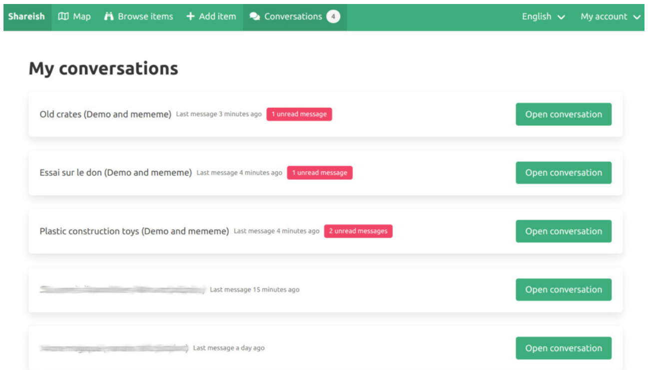

Figure 8: Shareish UI for online conversations with notifications of last unread messages.

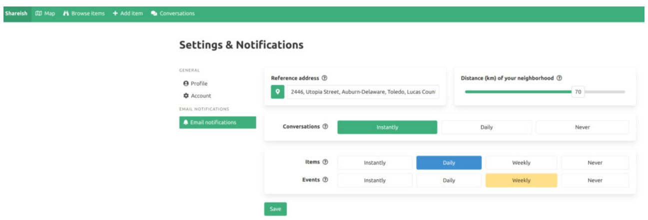

Figure 9: Shareish UI to configure notification parameters: the reference address and distance used when the user is offline to filter items and events in their neighborhood; and the frequency of notifications (instantly, daily, weekly, never) for conversation messages, items, and events.

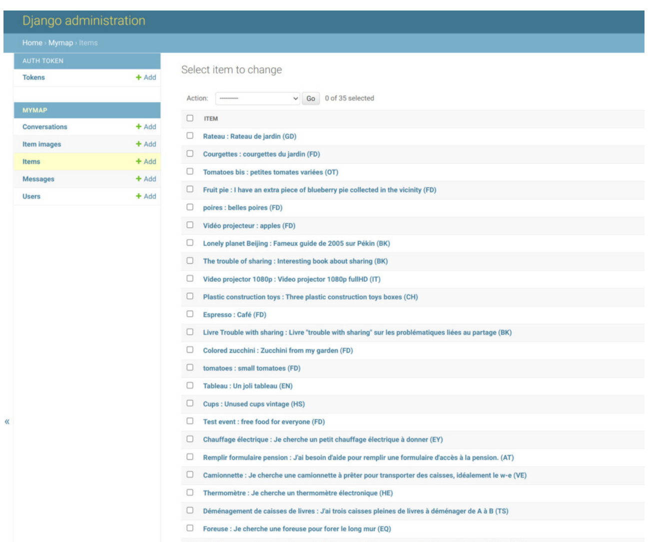

Figure 10: Screenshot of the administration module for moderators to curate content (create, add, update, delete).

3.2 Assessment of the auto-tagging module

In this Section, we evaluate the potential of the AI module to ease content creation [Reqt 5]. First, to assess the performances of the deep learning model to predict the title and category of an item, we used a test set of 30 images (taken by a smartphone) of realistic images of items that might be uploaded on the platform. This test set includes pictures of various food and supplies, various books and toys, ... Figure 11 shows a subset of the images and corresponding model predictions. Out of the 30 test images, 12 item titles were correctly predicted (the top-1 answer is the correct object class), for 8 other images the correct object class was among the 5 first predicted classes. In total, two third of the images received a plausible class prediction hence its predicted item category was revelant. Overall, these empirical results and feedback from users confirm this model is interesting to predict an item category but not specific enough to predict an item title, which can be explained by the fact that the model was trained to recognize original ImageNet classes (corresponding to 1000 nouns of the Wordnet hierarchy) rather than fine-grained classes. In the future, we plan to exploit more recent models that have been pre-trained on an extended version of ImageNet with 21K classes [72], and to combine predictions from multiple images.

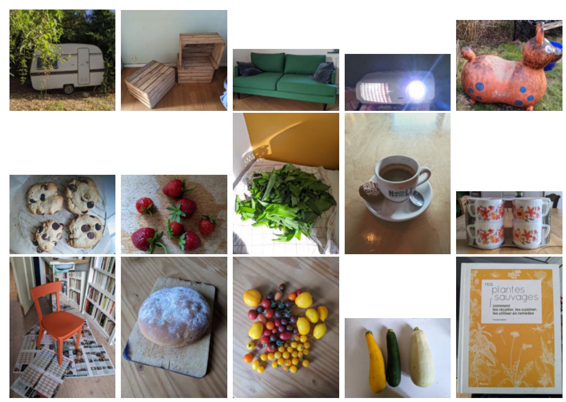

Figure 11: A subset of item images used to evaluate the auto-tagging module. ImageNet classes with the highest probability estimate are: 1) recreational vehicle, 2) crate, 3) studio couch, 4) projector, 5) piggy bank, 6) dough, 7) strawberry, 8) broccoli, 9) espresso, 10) cup, 11) library, 12) stingray, 13) corn, 14) zucchini, 15) book jacket.

Our second evaluation is related to text recognition where we used a testbed of 100 books (in English, French, or Spanish language) with various text fonts and colors. In order to evaluate the performances of different recognition strategies, we took three pictures (taken with a single smartphone) for each book: the book jacket, the book side, and the barcode on the back cover. We ran both pre-trained Tesseract and CRAFT on the two first sets of pictures, and pyzbar on the third set. An illustration of the task is given in Figure 12. Over the whole test set, the best performing method is pyzbar on the barcode with 83% book accuracy (83 among 100 books are correctly identified), followed by CRAFT on the book side with 81% word accuracy (with respect to ground-truth book title and author), 80% on the book cover, then only 6% word accuracy with Tesseract. One should note a good word accuracy does not guarantee the book is correctly identified, so with text recognition approaches on the book cover/side, an additional query (e.g. to an external library API with detected words) might be needed to identify the book. Such a two-step approach with CRAFT leads to a 61% book accuracy when applied on the book side. These empirical results will drive the development of a new design that will recommend users to associate multiple images to an item: an image of the bar code for fast and reliable recognition, then the frontal view for visualization purposes. Other design choices for effective human-AI interaction are clearly worth investigating to reduce the time users spend entering or searching items on the platform [Reqt 5], but these applied research questions are beyond the scope of this paper.

Figure 12: An illustration of the computer-assisted recognition of books. (Left) Detected text boxes with CRAFT on the book jacket: "ars brear childs anarchy to guide ly by b john jana ". (Middle) Detection on the book side: "a rule ls to break a childs guide to anarchy manic d press". (Right) the well-recognized barcode (978-1-933149-257) with pyzbar.

4 DISCUSSION

Shareish is an interactive system to foster localized generalized exchange by combining modern software technologies. Our user interfaces were designed to make non-monetary exchanges at least as user-friendly as commercial transactions on e-commerce platforms. While the system will be continuously improved throughout iterative and incremental development, there is no one-size-fits-all software program. Such a project can not be implemented in a void but rather will be conditioned by the community in which it is applied. Therefore, the platform is distributed under an open-source permissive license to enable replication and local adaptation by groups seeking autonomy [35]. In parallel, research on kindness, giving, cooperation, generalized exchange, and indirect reciprocity is very active [9, 16, 31, 41, 57, 63, 86, 94, 96] and social researchers are keen on performing large-scale interviews with people involved in such communities. We believe Shareish might also help to conduct such kind of empirical research. Again, it certainly does not fulfill all the needs of such studies, but in contrast to proprietary social media platforms, its open-source principle would ease data extraction and extension of software functionalities to meet the needs of interdisciplinary HCI and social research. Overall, we believe open source development is a necessary but most probably not sufficient condition for sustainability "in the wild" as it has previously raised various HCI concerns [88], the survival of an open-source project is not guaranteed, and its governance is not straightforward. Towards autonomy and sustainability, previous works [1, 3, 13, 25, 69, 71, 80] suggest to investigate further modern open source development practices (such as monitoring online development on collaborative infrastructures), coordination and communication strategies to increase participation and maintain community dynamics, practices inspired by platform cooperativism, participatory design, and commons. A long-lasting influence should be sought by conducting in-depth case studies and by bringing together various stakeholders. We plan to contact different communities (through neighbourhood committees, grassroots movements, and organizations concerned with solidarity) with whom, in a second stage, we might assess the relevance of creating a participatory structure trying to account for the needs of decentralized user and development communities.

Finally, one might also see our work as a prototype of various utopian imaginaries of universal solidarity sketched by various authors: a community-owned "general catalog" [75] of free products and services, an infrastructure supporting a decentralized non-monetary economy in a post-market society [24], a "digital feedback infrastructure" implementing solidarity-based processes to match problem-finders and problem-solvers outside of the commercial realm [58], a working prototype of a "civic platform" to combine both efficiency and solidarity [59], a digital tool for community sharing and alternative neighborhood plans [68], a way to digitally organize a multitude of decentralized economic practices or community economies [26]. It would be interesting to study the links between these works and to assess if future versions of Shareish could play a role in such a wider context.

5 CONCLUSIONS

To the best of our knowledge, Shareish is the first open-source, online, map-based, interactive system to enable generalized exchange of specific, geolocated, goods and services. The platform is grounded in prior work and it was designed for 'human' rather than market needs with the objective to facilitate the people's ability to meet their own needs through new community relations. From a technical perspective, it is innovative in the way it integrates various modern technologies to ease user experiences. The platform is ready to use and can be replicated and extended freely. It might be of interest for various communities including grassroots movements, emergency response organizations, social psychology researchers, and CSCW developers.

6 AUTHOR CONTRIBUTIONS

AG implemented the first Shareish prototype. FB and UR extended it by contributing to large parts of the source code. PC performed and analyzed auto-tagging experiments. RM devised and coordinated the project, made contributions to the code, and wrote the manuscript with input from all authors.

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A ONLINE RESOURCES

A demonstration server is available online at https://shareish.org/ where readers can sign up. The source code of the whole application is distributed under an open-source permissive license on a public repository for collaborative development (https://github.com/shareish/ where v0.3 corresponds to the version at initial paper submission time). A complete installation procedure (for production or development mode) is also provided. The dataset of book images for auto-tagging evaluation is available as Supplementary Material on ACM Digital Library.