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Title: 'Locally' connecting Ocean View's Business Community

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Category	Min	Max	Chosen
Requirement Analysis and Design	0	20	20
Theoretical Analysis	0	25	0
Experiment Design and Execution	0	20	5
System Development and Implementation	0	20	15
Results, Findings and Conclusions	10	20	10
Aim Formulation and Background Work	10	15	10
Quality of Paper Writing and Presentation	10		10
Quality of Deliverables	10		10
Overall General Project Evaluation (*this section allowed only with motivation letter from supervisor*)	0	10	
Total marks		80	

'Locally' connecting Ocean View's Business Community

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ABSTRACT

This paper covers the creation of a business directory application to be deployed on the iNethi Community Wireless network in Ocean View (OV), a peri-urban area in Cape Town. Locals in OV are often severely bandwidth-constrained due to the high cost of data in South Africa; they are thus excluded from partaking in the digital side of the economy, where much of the informal business communications happen. Previous research has shown the potential for ICTs to help uplift marginalised communities, and, although the need for a business application was known to the iNethi team, there was, until now, insufficient capacity to explore what potential users precisely wanted. The idea behind this project was to explore and design an application to assist the thousands of estimated businesses in OV utilise the data-free nature of a local application running on the iNethi servers, using Human-Centred Interaction and Participatory Design principles. This research and development process involved interviewing a director of OV COMM DYNAMIC, the executive board of iNethi Wireless Network, and several residents and small business owners in Ocean View. A business directory was found to be the most desirable outcome for the research participants, and the feature set, user-interface and system were then co-designed through user-evaluations of prototypes. *The Hustle* application, as it is so-called, allows business owners to accurately convey all necessary information about their businesses and brands to their customers, to be found by new customers, and to build rapport within the community; the mobile-optimised site allows anyone to search the directory based off user-determined categories, location and price, while viewing photos, reviews and contact information of local businesses without incurring data-costs. *The Hustle* brings the OV business community and its customers together, breaking down the digital divide between those that have and those that do not, and provids open access to valuable economic information to better produce a competitive and sustainable economic environment in the township.

CCS Concepts

• Community Wireless Networks • Wi-Fi

Keywords

Informal Economy, South Africa, Disadvantaged, Hustling, ICT4D, HCI4D

1. INTRODUCTION

This paper presents a web application that allows business owners to publish their information to a local business directory. *The Hustle*, as it is so called, will run locally on the iNethi community wireless network in Ocean View (OV), Cape Town. It will allow data-free advertising for local businesses and aims to bring valuable information to residents that will hopefully, in due course, help establish the micro-economy by connecting businesses and consumers. Businesses can publish blurbs, location data, price lists, photographs and contact information to help consumers understand them better. Consumers can search deeply through various business categories, save favourite businesses to their profile, leave reviews and use links to the broader internet. Currently, for local business owners to advertise their business, they rely on word-of-mouth, Facebook posts and putting up posters near shops. These inefficient communication channels result in poor access to information, thus limiting potential economic activity in OV. Furthermore, many businesses rely on data-intensive platforms to communicate with their customers. Data is not a commonplace commodity in OV, with many residents going for up to half a month without data due to its high cost. Thus, irrespective of a business owners' zeal, idea quality or successful business case, many potential customers are excluded from being reached by entrepreneurs due to purely financial limitations. Using *The Hustle* negates this barrier to entry due to the app being run locally on the iNethi server, anybody in OV can connect to the system for free. As a small business owner in OV responded in an interview, "yes, this will be a good system because you see, people will always first use what is free".

Thus, this study sought to be user-centric by solely focussing on meeting the needs of the OV community and designing with them in mind. This aim was broken down into three sub-questions that are explored in-depth later. *The Hustle* allows entrepreneurs to connect with each other and others in the community. It allows for a wide variety of listings categories, anything from skills and services to extra resources available for hire, to loan or for sale. A user may have multiple business listings where they may upload pricelists, contact information, location data and category tags. These business listings can then be reviewed by the community to ensure reliability for the consumer and provide a platform for entrepreneurs to gain rapport. Therefore, the app provides enough of a structure to inspire entrepreneurial thinking around how one could earn the user extra income, and start a business, but is not too invasive as to eliminate the variety of trading and collaboration that currently exists informally in OV.

An overarching aim of the project is to design a system that will meet the needs of the Ocean View community. The iNethi network and the features it offers the community are pivotal in the movement to provide equal access to the internet across all communities in South Africa. Building an addition to the platform is a privilege that could help thousands of business owners better connect with their customers, and each other. In economics, the ideal state for an economy to operate in is called 'perfect competition'. A prerequisite for this state is perfect access to information. *The Hustle* is a stepping stone to that ideal.

2. CONTEXT & RELATED WORK

Due to the lack of infrastructure and widespread poverty, many members of township communities (peri-urban areas that are a legacy of apartheid South Africa) have limited access to data. [2] The high cost of communication in Ocean View, alongside the fact that users communicate predominantly with others in a small locality, lead to the establishment of the iNethi Community Wireless Network.

OV was established during Apartheid as a low-income area for people who were forcibly removed from areas such as Noordhoek and Simons Town under the group areas act. It is currently a mixture of formal and informal dwellings and is still an under-resourced area.

The iNethi (meaning 'network' in isiXhosa) Model is deployed and managed by the board of directors. The OV COMM DYNAMIC, as they so named themselves, were initially all residents of Ocean View. This team, alongside a few researchers, have set up local servers and multiple Wi-Fi hotspots through which the community can freely access a range of local resources.

The iNethi network is a community-owned wireless network in Ocean View in Cape Town, South Africa. The system was created to offer not only members of the Ocean View community access to cheaper internet but also encourage content sharing between the people in the community.

It utilises open-source software to share files and to allow people to communicate; this is done using NextCloud and Diaspora, respectively. [5] The network provides wireless internet over television white spaces and Wi-Fi mesh, which is accessed at Wi-Fi access points. [2] This creates an affordable and easy to use network that anyone in the community can purchase data for, at R20 a gigabyte (GB), and use freely.

The vast majority of residents in Ocean View are bandwidth constrained since data rates in South Africa are comparatively expensive when compared to the income of residents of under-resourced communities such as OV. [5] Due to this, there is a need for the iNethi project to continuously develop local services and applications so that the community can utilise the network to minimise mobile data usage.

After reviewing the literature and having examined the context of the iNethi network (acknowledging the turmoil and poverty of the township that is indicative of the unemployment levels in the country as a whole) the activity known locally as "hustling" to make ends meet was identified as a major source of income for community members.

Hustling is the informal term for the exchanging of a seemingly limitless number of goods and services by individuals amongst their communities, often for economic survival. [2] ICTs can and should be effectively employed to facilitate this kind of informal trading. [5]

These transactions predominantly take place using digital platforms such as Facebook nowadays. A study by Wyche et al. [10] suggests, as logic would have it, that the more successful hustlers have more extensive social networks – in both the virtual and the physical.

Unfortunately, there is a distinct lack of research done in the area of hustling, particularly in the South African context. The author speculates that this is due to the highly irregular nature of these sorts of transactions being difficult to study.

Street trading, the informal selling of a set variety of goods at specific locations, is a much better document process in academic literature. Spaza Shops and vendors having been studied extensively in South Africa and abroad. [2] The findings of these studies draw some insightful conclusions on the informal economy as a whole but do not affect the content of this paper meaningfully.

New forms of trading that have been disrupted by ICTs were explored and, a common category emerged among many of the big names (think Uber and AirBnB), the Sharing Economy.

The Sharing Economy (SE) is an economic model based around peer-to-peer interactions without the transfer of ownership (although that factor is not held stringently in the following section). These interactions are generally governed by the individuals themselves based on guidelines set forward by the company. [10] The SE has grown out of the idea that buying and owning things is outdated. [2]

The term collaborative consumption can also be used to describe SE initiatives. Botsman and Rogers popularised it in 2010 in their revolutionary book, *What's Mine is Yours* [5] in which they advocated for and largely predicted the rise of the SE. The term was however first used in 1978 by Felson and Spaeth. [10]

The SE on the whole also distinctly lacks platforms that are designed for assisting in the complex nature of the informal economy, especially in the South African context. Merely providing access to economically meaningful information, like an online directory service, is crucial to stimulating entrepreneurial collaboration and can improve economic activity and revenue significantly when effectively implemented. [2,4]

The four principles to ensure a functioning SE, according to Botsman and Rogers, are: 1) the idling capacity of people (i.e. how much stuff do they have to share – be it time, a bedroom or old clothes), 2) the level of trust between strangers within a community, 3) the ability of the SE to hit critical mass (i.e. gain enough people to make the platform attractive to use), and 4) users need to have a strong belief in the commons. [2,4]

There are six major areas within the Sharing Economy. Each of these sectors are characterises by its main competitors. Each of them exhibits unique factors that may limit this SE from impacting the informal economy in South Africa. One in particular though, the transport industry, has presented significant opportunities for many drivers in SA.

The transportation sector of the SE internationally includes well-known e-Hailing services such as Uber [12] but also consists of a few other exciting transport services. These include the "Airbnb for boats", Boatsetter [13]; Turo – renting your car to strangers [14]; JustPark – renting your driveway as parking space in urban areas [15]; Zimride – a ride-matching service [16]; and more. [8] A limiting factor in the transport sector of the SE is how few own vehicles who participate in the informal economy of South Africa. This, on the other hand, presents itself as an opportunity too. The carpooling apps of Jrney, JumpIn Rides and CarTrip are all looking to gain traction in SA at the moment, with none really showing signs of inclusivity towards underprivileged users. [17–19]

The marginalised have always been the ones who bear the brunt of exploitation. As with all problematic situations, some try to find solutions. This was the promise of the SE for disadvantages communities described by Dillahunt and Malone. [4] Their paper set into motion the direction for this project.

Dillahunt had been asking similar questions for some time. For example, in an earlier paper [3] he posed, "How do people foster

connections for employment in economically distressed areas?" His answer pointed him in the direction of the Sharing Economy.

Drawing on previous works to supplement their study, they contributed significantly to the HCI4D (Human-Computer Interaction for Development) literature. [4] Their methodology was sound, and their limitations were stated adequately. Their contributions are identifying factors that contribute to the successful usage of the SE for underprivileged communities and suggesting mitigations to the shortcomings of the SE in these communities. [4]

A novel success factor that they proposed was the unwillingness of underprivileged user to trust technology. These same users had no problem trusting the people using the app, but rather the app itself. [4] This factor can be overcome by using transparent design and communication techniques. A better understanding of how technologies work and which applications are available will also broaden the horizons of users and result in them being more trusting of technology.

To mitigate security concerns, they found that participants in their study desired to meet in safe physical spaces, such as police stations. This is especially necessary if locals do not see their community as being 'good' overall. [4]

In the same study [4], the researchers implemented participatory design techniques with the underemployed and unemployed. The purpose of the workshop was to establish the viability of various SE applications in their respective neighbourhoods. Leveraging cultural probes, role play, and by utilising a combination of small group and large group discussions, their use of human-centred design is applaudable. Following in their footsteps is especially important when we as researchers are trying to understand entirely different experiences to our own.

In late 2018 there was an outcry by South Africans about the high cost of mobile data. [6] The situation has not drastically changed since. Due to this, in the iNethi context, the applications that run locally are more attractive to users as they are data-free. [7]

Designing new applications for the iNethi context with the community has been highly prioritised in the participatory partnership that is at the foundation of the project. [7] Many users in the Ocean View context only own feature phones (mobile phones with basic internet capability), and this is one situation where designing a solution around their access to technology could enable them if done correctly; or isolate them if not.

Designing an application that is easy to use for digitally semi-literate users should be the aim of developers. A team from India developed a voice-based exchange for illiterate users. [11] This sort of innovation is necessary to create an inclusive SE.

Arsel found that the informal economy meets the sharing economy at the edge of ownership and transfers. [4] The informal economy in South Africa has not seen some of the breakthrough in this area as have some of the other African states. [5] The author suggests that this is due to a lack of community-centred design in the local attempts. [13]

This overlap is bartering, which has been given a breath of new life, with the internet springing up several new platforms. There is a disparity in view in the literature as to whether a monetary or non-monetary exchange is better, the former being argued as superior and the latter being argued as more fun. [18]

Arsel, now in his own work, explores the emergence of several new online bartering communities. [1] Online bartering, borrowing and swapping systems come in many forms. Most use some kind of points or reputation system as a form of currency, whilst a few are entirely free to use.

Rötheli suggests that monetary exchange is far superior to bartering. He based his finding on the statistical analysis of utility across eighty students from a German university [9]. Although convincing in his logic, this finding may not apply to informal settings.

The review of the literature resulted in the author concluding that the SA informal economy has the potential for growth due to ICTs despite a few limitations found. It was noted form a Tanzanian study that a business directory could significantly change the economic landscape. [5] This would be the simplest form of a SE implementation, sharing information.

COVID lockdown regulations resulted in the author being unable to examine the community sufficiently as no in-person contact was allowed. This paper thus details the addition of a business directory web application to the iNethi network.

This need was explicitly identified by the community, and interviews with community business owners have informed design decisions throughout the project. Open-source code was utilised and adapted (thus following in the footsteps of previous iNethi implementations) to maximise the benefit to the community.

This addition to the iNethi network, *The Hustle*, takes bandwidth constraints into account and accommodates for the fact that the majority of users will be accessing the local content features using cell phones, rather than a computer, as this is the most common means of access to the internet in low-income areas in South Africa. [13]

3. APPROACH AND DESIGN

3.1 Ethical Issues

Before beginning User Evaluations, the researcher acquired Ethics Clearance from the UCT Human Research Ethics Committee (approval code FSREC 037- 2020). All users were given an explanation as to the nature of our research, to their voluntary participation, and to their right to withdraw from the research at any point without experiencing prejudicial treatment. Consent was planned to be obtained by one of three methods depending on circumstances. Due to the COVID-19 lockdown preventing in-person contact, the first two methods were non-contact specific and were used in all cases.

Digital consent, the first option, was obtained by sending the participants a summary PDF of the research and consent form. Participants were then messaged as follows, "[this] is an Ethics Statement designed to protect your rights. You can consent or object in this chat or I will verbally confirm your consent on the call."

Consent was then confirmed on the call before recording began, and, upon recording starting, consent and the details of the conversation were then confirmed for the sake of the recording.

3.2 Approach

In order to meet the aims of the project, a participatory design approach was taken. Utilising participatory design meant that user feedback and input was part and parcel of the design process.

Furthermore, once a feature had been designed (or theorised), it was shown (or explained) to participants and feedback from them was then considered. The result is that no feature became finalised (or, most often, even came into existence) without input from

prospective users. This approach contributed to the shift away from a highly SE focussed solution to a more traditional directory service, at least for now, as participants were more in favour of a simpler system that could be used immediately.

An agile approach to software development was chosen to facilitate this human-centred design methodology, as the iterative nature of agile development allowed prospective users and other stakeholders to give their feedback throughout the project so that it could be incorporated into the development process as early as possible. Additionally, an agile approach was imperative, as the timeframe of the project was short and did not allow for time to spend exploring avenues that were not of core importance.

At a high level, there were four phases to the project.

- Phase one involved the initial engagement with a director of OVCOMM DYNAMIC, the implementing partner in OV that works with the founders of iNethi. Here we informed them of the project and gathered their views on how the project should go.
- In the second phase, interviews were conducted with relevant parties (usually business owners in OV) which were identified by the directors. This was done in order to refine the project and develop a clear understanding of the community's needs.
- In the third phase, the application development began, and prototypes were tested with participants.
- Lastly, user feedback was gathered on the final deliverables to verify whether the project aims were successfully achieved.

The application was worked on and tested in a sandbox environment to avoid causing issues on the iNethi network. Docker containers were used to ensure that the application would be shippable on the iNethi servers without any major difficulties (although this assumption proved to be untrue).

Docker allows developers to run their applications on any server as a lightweight, portable and self-sufficient container. Multiple containers are run congruently from a single YML file. These containers were Nginx, MariaDB & WordPress.

Nginx, a popular lightweight web application, was used for developing the server-side application. MariaDB is an open-source relational database. WordPress was the base platform for managing, editing and interacting with the .php, .js, .html and .css codebase.

3.3 Requirements Analysis & Design

Presented below are the main factors that influenced the system design.

3.3.1 Justification of Design

When planning how users could interact with *The Hustle*, the author began to see a dichotomy forming. Either he could prioritise the stability and accessibility of the app, or he could focus on feature richness and speed. Due to the real-world, community-based nature of the project, he opted for the former option.

From a front-end perspective, at critical points in the design process, business owners in the community were interviewed (as they are the most likely beneficiaries of the final system). Their feedback allowed their opinions to be factored into the final user-facing design.

3.3.2 System Sustainability

This resulted in a slightly more clunky and slower implementation but, one with which will be easy to maintain, upgrade and modify. The design process followed has resulted in a modular and robust system which is detailed in the appropriate diagrams in Appendix 4 and 5 (the WordPress Database Schema and the System Overview Diagram, respectively).

From an application side, a crucial part of the sustainability of the system was designing a directory where the entrance requirements were low enough to enable anyone to use the service. A major part of the system is the search by category functionality, and this was designed so that a sufficiently wide array of business categories is catered for in the website design.

The category list was drawn from users, reviewing the Google Business categories, and from social media posts of current businesses advertising in OV. Businesses are also able to select multiple categories so as to be found in different searches if they crossover to different sections.

The functionality is generalised enough that, with a simple admin category addition, the scope can be broadened even further to include new entrants to the OV business community. Logically, that idea is seen to be sound, with comments reporting that *The Hustle* is the modern-day equivalent of what the Yellow Pages or a community noticeboard were but a few years ago.

3.3.3 Computer Science Techniques

Inheritance and generalisation techniques were employed in the category tagging process, as categories have sub-categories so that, if a higher-level category is searched for, all businesses tagged by sub-categories will also appear. This allows for more helpful and accurate searches for users. Businesses are also able to select multiple categories for their listing, and this ensures that the business will not be lost due to category semantics.

Following a ground-up process, all components are abstracted sufficiently, and Object-Oriented design has resulted in the system being easily exportable to any web server with WordPress capabilities. *The Hustle* can also be run locally be executing a single docker command which will then execute all dependant containers. Database persistence outside of a single instance was implemented by mounting the data outside of the MariaDB Docker container.

3.4 Experiment Design and Execution

3.4.1 Experiment Design

This section begins with an overview of what methods were used for the fieldwork; it then details the phases of participation and how each phase was planned, structured, and the purpose for each of them. Finally, the recruitment process is explained and discussed in terms of what worked and what did not.

Although this project was not entirely experiment-based, major elements of the design philosophy implemented were based on three basic design questions; and Human-Computer Interaction (HCI) principles and User-Centred design guided how this project was to answer them.

They are:

1. "Is there a need for a business application in OV (that can run on iNethi)?" (this was assumed true and validated pre-proposal based on previous research)

2. "How should we design it?" (i.e. In what form would the community most appreciate a business application) and, lastly, after the application is being designed
3. "What suggestions for improvement do users have?"

Introductory, probing research was carried out to confirm and sufficiently answer the first and second questions, respectively. This was done through interviews and user 'snowballing' to find apt interview candidates from there. These interviews were roughly aligned with the questionnaire attached at Appendix 2. Following the initial round of interviews, user evaluations on early versions of the website were performed. The purpose of this user-involvement was to better understand the context, problems and desired solutions of those whom the system was being designed for.

During user interactions, the researcher would often present how he envisioned the specific user might best use the system to prompt the users' thinking. Asking good questions to extract the most valuable information was vital to a successful interview (that is, one where sufficiently useful information was collected). [18] All interviews were recorded for later analysis and review.

One particular director for OV COMM DYNAMIC sent through a list of appropriate participants for the research following his interview. He has a passion and knowledge on the economic activity within OV, which allowed the researcher to gain a better perspective on the problem that was going to be solved.

Of the fourteen potential candidates, only five responded affirmatively to the offer to participate. Some community members responded with eagerness but did not respond to follow-up requests; others went radio silent following the consent check.

Of the interviews that were had, three were extremely helpful. Interestingly enough, two of them requested for the researcher to obtain verbal consent instead of written. It is speculated that the attempts to obtain written consent may have been a deterrent to many people, while the rest may just not have had time-capacity to spare. Due to the low number of interviews, tagging the transcriptions was abandoned as a qualitative analysis method and, instead, notable quotes and ideas were built into the paper and system, respectively.

Candidates were identified as appropriate for subsequent interviews and user-evaluations. The users were asked to complete a number of tasks on the website and were to respond with their feedback.

All participants received a 1 GB voucher to the iNethi network and R20 airtime for their time and to cover any costs they incurred by engaging in remote interviews. All interviews with community members were conducted over phone calls, which were recorded for later analysis (as per their consent).

User-evaluations were the final phase of user participation. The following were the options they could test on the site.

- Register for an account

- Create a business listing

- Search for your listings by tag, text or location

- Leave ratings on businesses

- View & change your profile

They were asked to also report bugs, comment on how intuitive the user-interface and interaction was, and to give design suggestions.

3.4.2 Experiment Execution

Successfully executing the project was a direct result of having regular Microsoft Teams meeting with supervisors, the UCT HCI community, and a technical expert and founding partner of the iNethi network. Emails, meetings and text communications with the supervisors & fellow honours students ensured a constant and helpful pressure to keep the project on track.

The first design question was assumed to be true and was confirmed in the affirmative during all research interviews and by those who have worked on iNethi over the past four years.

Executing the experiment design for the programming aspect of the project was split between backend design and front-end design. The front-end design came predominantly from HCI principles during user interviews and knowledge gained during the literature review of previous research in similar circumstances.

The backend execution was conducted according to Computer Science (CS) design principles learnt during graduate CS courses and projects at UCT, as well as work for external companies, and is detailed below.

An iNethi expert and the lead technical expert on the system was consulted regularly via video calls, emails and text messages. Due to the external nature of his involvement, his suggestions, albeit always being extremely helpful, were sporadic. This resulted in much wasted time on issues that he later solved. This delayed the project timeline significantly, resulting in a shorter than planned timeframe to do the final user-testing.

This setback included initially setting up an AWS S3 instance that the researcher was prescribed to do testing on. A month after this suggestion and many unsuccessful attempts at achieving this task, it turned out that a sandbox was the preferable option and the original direction deemed unusable. The new setup was declared ready for integration attempts on 28th August, seven weeks after development had begun. This was not seen as an issue at the time, because onboarding the application was supposedly plug 'n play.

Following concurrent development issues on the sandbox, a process to resolve issues, and help from a partner, the integration seemed imminent. A student also working on the iNethi network, began to understand and pioneer the process to follow for integration based on the expert's advice.

He was a source of technical guidance and for the latest developments over WhatsApp and MS Teams Calls. In the final planned week of development, the researcher managed to troubleshoot his way through all the required integration steps to no avail. The iNethi expert is still in the process of understanding why the site is not functional. This issue will undoubtedly soon be resolved, and the site is live on a web server owned by a private company run by a friend for testing purposes.

Final user-evaluations were thus still able to be performed, and the website had been successfully iterated multiple times. An MVP feature set had been achieved, in addition to a few extra features. Finally, the site was sent to over twenty participants for evaluation. Several bugs were discovered, and the final iterations were made.

Due to the short timeframe, it was not feasible to analyse usage statistics in order to test whether the application met the user's needs (and this was never the plan). Instead, the testing and evaluation of the application was qualitative and involved asking users for their opinions about features, flow and user experience.

The final focus of this process was conducting cognitive walkthroughs to discover usability issues and to get an idea of

how intuitive the system is. The results were encouraging of the design, and the response rate was adequate to affirm future feasibility.

After the first round of interviews, an additional eight potential participants were contacted in Ocean View. All of them did not respond. Thus, alongside the original candidates that were usefully interviewed, and the director, an additional seventeen friends were asked to also perform the user-evaluations. They were given the context and asked to, because of it, test the website particularly on their phones.

Hence, this allowed the researcher to adjust features based off of empirical evidence and for him to become aware of the technical limitations of the prospective users. Additionally, users were asked for feedback after these walkthroughs in order to discover any further changes they might want or new features they would like to see.

4. PROCESS & IMPLEMENTATION

4.1 System Development

The Hustle application was systematically developed from the highest-level down. Immediately after the architecture model and application stack was confirmed, the base components were built the following dependencies (Docker → Nginx, MariaDB → WordPress). The researcher had to learn PHP and revive his long past HTML skills but managed to successfully develop the system with help from a few experts in the field.

When these basic systems were all functioning together, the database was persistent, and a simple application was stable, the functionality determined from the user-testing began being built. This was managed in a sprint backlog which was groomed weekly.

From the start, developing the MVP was the main priority. Thus, the essential features were built first; and stability was prioritised over functionality. This being said, many want-to-have features have graduated from the backlog and are functional on the site currently.

4.2 Features

The system has two primary user personas; a business/venture/organisation owner/manager and a customer. Each of these users has different problems and solutions that *The Hustle* solves. These personas were generated from user interviews, cognitive-walkthroughs, previous research and user-evaluations. Thus, the feature set was organically grown from the discovered needs and wants of the OV community. The perspective of the business owner is detailed first, followed by the user's; lastly, additional features are detailed. (Screenshots of the application can be seen in Appendix 1 & 2)

4.2.1 Business Owner Persona

The current problems faced by the business owner are that they are not reaching enough new customers with their current marketing mix (word of mouth, posters outside shops, and social media posts), and they have nowhere to point their customers to view static information about their business, and potential customers cannot connect with them due to bandwidth constraints (such as the lack of residential Wi-Fi in OV and the high cost of data).

It thus follows that the business owner wants the business to be discovered by potential customers who are searching for his product/service, he wants space to adequately convey the brand

values, and he wants to accurately display relevant information to those viewing his business listing (such as pricing, operational hours, location, etc.) on this space. The owner also has no way of building rapport amongst the community, and this makes it more difficult to convince new customers of the business' reliability and standard. *The Hustle* solves these problems with the following features.

A user can create a business listing that will be displayed on the directory. This listing contains the following features that can be set by the user at the listing creation and edited at any point thereafter. The business is required to have a name. The business listing can then be categorised in multiple of the available categories. The owner can set the pricing model of the business, upload pictures of the business, add a phone number and email address, and add a location. The name, featured photo, categories, pricing and location are displayed prominently in a tile in the directory UI (see Appendix 1). Within the listing, a dynamic, large text field can be used to display price lists, the business mission and vision, contact instructions and links to the internet and device apps (e.g. to Facebook pages, the default phone or mail application, or WhatsApp chat). Typographical emphasis and lists are available to customise and structure the field as the owner would like. (see Appendix 2)

4.2.2 (Potential) Customer Persona

The second persona *The Hustle* is aims to provide solutions for is a resident of OV who is looking for a business to provide them with a product or service to solve a problem for them. They may also not have access to the internet and only have a mobile phone. They also, upon finding potential businesses to frequent, do not have any basis for trusting that the business actually does what it says it does. *The Hustle* solves their problems as follows.

They can, without creating an account, do a simple, multi-variable search across all businesses listed in *the Hustle*. This provides them with relevant businesses based on location, category, name and any other information added by the business (e.g. slogan). Within the search results, they can view the star rating of the business, pricing and structure. After performing a search, the user can select to be notified of new listings within that category using an RSS Feed. Upon tapping a listing, they are then presented with the full details of the listing, options to contact the business and full reviews of the business by other users of the business. After transacting with the business, the customer can then leave a review for others to immediately see. The website, using a cookie, can remember your details for future reviews without creating an account if the optional checkbox is selected.

4.2.3 Additional Features

Other key aspects of the system to be mentioned are: the security, by sending unusual or offensive comments to be moderated and by requiring a unique phone number per user and name per business; the scalability due to the plug 'n play with any 'Dockerised' system; the ease of which the system can be maintained with the extensive README files; the caching of images helps speed up the loading time of the site, but this will largely depend on the device-specific connection to the server; well-documented code and clear suggestions for future work, which has already begun.

A few users will also have Admin privileges, upon request from the community, to act as watchdogs to moderate any unwanted, illegal or fraudulent interactions on the site. These admins receive email notifications upon new user registrations to keep abreast with the status of activity on *The Hustle*. The WordPress content

management system (CMS) was retained to allow these admins to view and edit fairly complex settings in a simple way.

4.3 Implementation

The Hustle was implemented using Visual Studio Code, Docker and FileZilla. The site was developed mainly running on a Docker VM accessed through Safari and edited using WordPress. The details of the technology stack and server integration are explained below.

4.3.1 Technology Stack

The architecture model chosen for *The Hustle* was largely predetermined by the current iNethi architecture setup. Thus, the system runs on four interdependent Docker containers, all of which are utilised by other iNethi services. A WordPress database diagram and the system overview be view in Appendix 4 & 5, respectively. The current architecture model guided the process of selecting which technology services to use, to ensure less complicated integration.

WordPress was selected due to its renown as being the global standard for balancing simplicity and power in website development. This ensures that the codebase is easily maintainable and will hopefully result in future improvements in speed and usability as software upgrades happen.

MariaDB and Nginx were selected because of the ease of integration between them. Also, bearing the future in mind, the base blocks required for the addition of SSL are already in place. Also, all three of the aforementioned services run in Docker containers and their code is freely available for "use, copy, modify, merge, publish" under the MIT license. [1]

The WordPress theme Robolist Lite was used as the base theme. In terms of plug-ins, Ultimate Member was used for user management, and WP Job Manager was the underlying code for listing generation and manipulation.

4.3.2 Integration with iNethi

In order to successfully deploy *The Hustle* to the iNethi servers in OV, the researcher had to access the Global Amazon iNethi sandbox by logging in to the Amazon AWS Console. A new DNS pointer was then created for the application in HA Proxy so that http://hustle.inethi.net could be locally navigated to, instead of an IP address. Nginx, MariaDB and WordPress are shared across multiple other services, so they only required tweaking to be compatible with the new application.

Theoretically, it should not be difficult to implement the website locally on the iNethi server, but, due to technical difficulties and reliance on a non-UCT resource, the last phase of the project was prioritised for user-testing at an online domain over integration to the OV servers. The software artefacts are created and will be deployed in conjunction with the iNethi team, hopefully before the project demo.

5. RESULTS AND DISCUSSION

Below I reflect on the key success factors laid out in the original project proposal; they are the ability of the writer/developer to implement a system on their iNethi network within the realm of

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[1] "A short and simple permissive license with conditions only requiring preservation of copyright and license notices. Licensed works, modifications, and larger works may be distributed under different terms and without source code." [1]

the project scope successfully (a business application, in this case); the stability of the final system; and the completeness of the base set of features which could make up an MVP; and a breakdown of the appropriateness of the system based on qualitative feedback from and based on potential future users. They are:

- Will they use it?
- Will they encourage others to use it?
- Do they like it?
- Do they think it's necessary?
- Does it support a wide variety of business use-cases?
- How easy was it to use?
- Is the system sufficiently developed for use?

It's been confirmed in the user evaluations and previous interviews that the system, as it currently developed, will most certainly be used (this, albeit, is said with the awareness that often, contrary to what is sometimes said, people only say things to avoid causing offence). Participants generally answered positively to the first five questions, and 'mostly' to the ease-of-use question. Based on these responses, the final question can be answered in the affirmative.

All OV residents that were interviewed who are also business owners expressed their eager anticipation towards being able to use *The Hustle* in its final form. They all also stated their own desire to introduce others to *The Hustle* and show them how to use it. They said that having the ability to point their customers towards their listing on the site was a "*good thing* (P1)" and that being able to be discovered by those searching and browsing on the directory was "a*n exciting thought* (P3)".

P2 said, *"If it is as simple as Facebook, I would use it…I would have no problem".* The same business owner specifically asked to be able to register without complexity; hence, only a phone number is required to become a user. P2 later reviewed the website with no complaints to the complexity and will hopefully have his listing to view online soon.

Remembering back that, "the overarching aim of the project was to design a system that will meet the needs of the Ocean View community", this website, when implemented, according to those in OV that were available for interview, will be a valuable addition to the iNethi system. The aim has been achieved insofar as the website is effectual online, only the implementation (the final deployment to the iNethi server) has not yet been finalised.

The importance of this addition is in bringing equity of access to those who exist in the margins of society. *The Hustle* brings business information that was once in the shadows of OV to an open-access and easy to use directory website. This allows businesses to better interact with their customers, and consumers to more accurately discover businesses. The rating system builds accountability and trust in the community. The ability to see and understand competitors makes for a better competitive landscape for all involved.

5.1 Reflection

Reflecting on how the project went, there are a few clear areas of success and a few key areas of difficulty (which have also been addressed above). The project went well in terms of the experiment design, the initial analysis, all parts of the interview and evaluation process (bar the attendance of the OV community), and the website development.

The learnings gleaned from the project are numerous, but are, most profoundly, the difficulty of remote communications and development, and the contrast between the goals of academia and how best to solve real-world problems. It seemed as though the academic process, whilst undoubtedly being helpful in many regards, hindered the ability of the researcher to bring into existence an application that could really affect the community positively. This, in part, is of course due to the learning process of completing one's first thesis but, as a lesson for those that may follow, be sure to not simply get washed along in the stream of academic procedure. Rather, intently pursue what your vision is for your research and strive to do all possible (within the boundaries of academia) to 'hustle' through the dogma.

Where the project fell short of expectations was with the abysmal response rate from OV residents, and the (current) inability to deploy the system on the iNethi server in OV. Neither of these problems were identified as risks at the outset of the project, and the researcher speculates that the false expectations of these difficult realities (i.e. people being fickle and unwilling to participate, and the remarkably complex process of integrating to the server) directly contributed to the end state of the research.

The recommendation made to others attempting a project on iNethi is to integrate early and ensure that you need not rely on external resources to successfully launch the code. Also, attempting to contact, interview and undertake user-evaluations with people remotely is difficult, especially so without in-person contact. It follows logically that the researcher would not recommend voluntarily beginning HCI research in a global pandemic, however innovative the proposed solutions may be.

6. FINDINGS & CONCLUSIONS

The testing phase of the web application uncovered a few key factors that would determine the final product. The scale of businesses in OV was also estimated to be far beyond what the researcher originally thought, with some calculations reaching approximately ten thousand micro-enterprises existing in OV alone. This equates to around a quarter of the population actively pursuing a 'side hustle'.

Another finding was the current methods of these 'hustlers' to reaching customers. They predominantly were reported to be placing posters on shop walls, and by advertising on localised Facebook Groups. Most of these entrepreneurs are reported to be opening a stall or shop from their houses (often using a spare room and serving customers through a window.) Early user feedback resulted in a pivot away from advertising businesses towards a business listing directory. (see Appendix 4 for the original design). This shift was predominantly because advertisements are used on social media, and this space was not desired to be replicated.

Simplicity is favoured by the community in a number of ways, including the opinion that online sales were not favourable for the majority of hustlers in OV. Cash was and still is king; the accessibility of cash to all (alongside the physical transaction meaning that business owners are able to build a relationship with their customers) trumps the efficiency of online payments in OV.

Having a static page to display one's business listing was reported by residents to be favoured over having an advertisement stream (as they currently use WhatsApp and Facebook for this and thus, creating another platform would be redundant). Administration privileges for those in authority were also requested. This was seen to be necessary to curb platform abuse and create a more helpful application.

Later, some grammatical errors, mobile view limitations and unintuitive design choices were uncovered in the testing phase of the project, and these changes are now implemented and stable. A major change was the addition of a mobile link to the *Add Listing* page and the reworking of the registering process away from the WordPress default to negate compulsory email address input.

The final application is scheduled to go be live on the iNethi platform by year-end. The minimum feature set was fully developed, and the next round of features are in the pipeline for future developers to implement. Ensuring this sort of continuity amongst researchers on iNethi has been emphasised as important since the beginning and, hopefully, will bear good fruit as *The Hustle* evolves in the years to come.

The Hustle application was found to be greatly desired by the community and is expected to have a profound impact if the iNethi integration goes smoothly and the site proves to be stable and maintainable as the months go on. It was amazing to see how a seemingly small application could largely impact an under-resourced community. The conclusion drawn from this is that simple ICTs can establish a more just and inclusive society by providing simple building blocks, in this case, within the economic system.

7. FUTURE WORK
The future work that can be done on *The Hustle* is endless, and as the community begins to adopt the platform, it may be used for purposes never imagined before. In saying that, it is crucial for future maintenance and development to continue if *The Hustle* is to make the transformative impact on the community that has been hoped for.

Thus, the following suggestions are put forward with their descriptions, ranked in order of relative importance as viewed through the eyes of the researcher. They have been formulated from a year's worth of learnings drawn from researching, developing and deploying the project with the OV community on the iNethi network.

Table 1. Future Development Suggestions for *The Hustle*

Feature	Description & Suggestions
Progressive Web Application	As most of OV residents are Android users, it would be profitable to adapt the site to PWA standards to make use of native notifications to drive engagement.
Contact This Business	A feature that would allow data-free communication between users of *The Hustle*. It has been semi-developed as a sidebar widget, but integration with iNethi chat would probably be more profitable.
SSO integration	iNethi has the building blocks of an SSO for all its services, linking the members may be a mammoth task, but one that is highly desirable to all parties involved.
Online Version Sync	This would allow non-iNethi users not connected to use *The Hustle*. Syncing the site to the World Wide Web potentially has cost implications. This has been done in other iNethi integrations, but the process is still being mapped out.
JSON extract	This would make the website faster and more responsive using a react JS site. Unique customisation abilities and better SEO are also options if implemented.

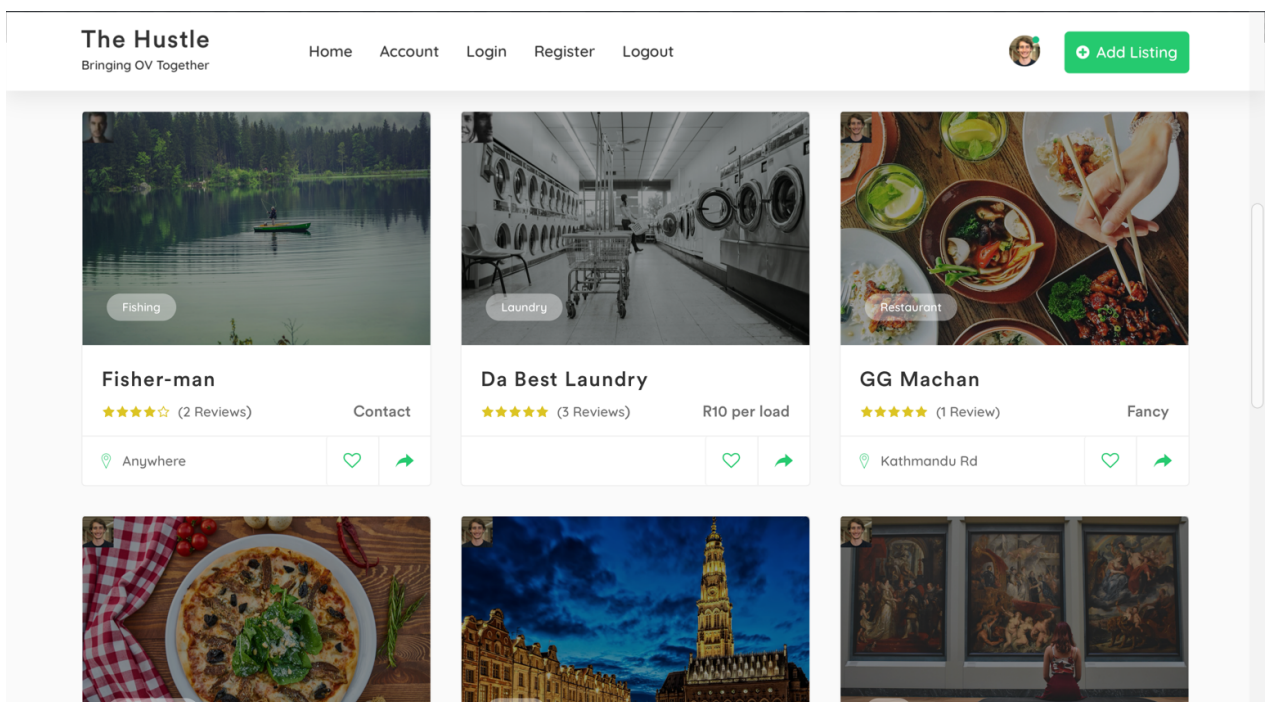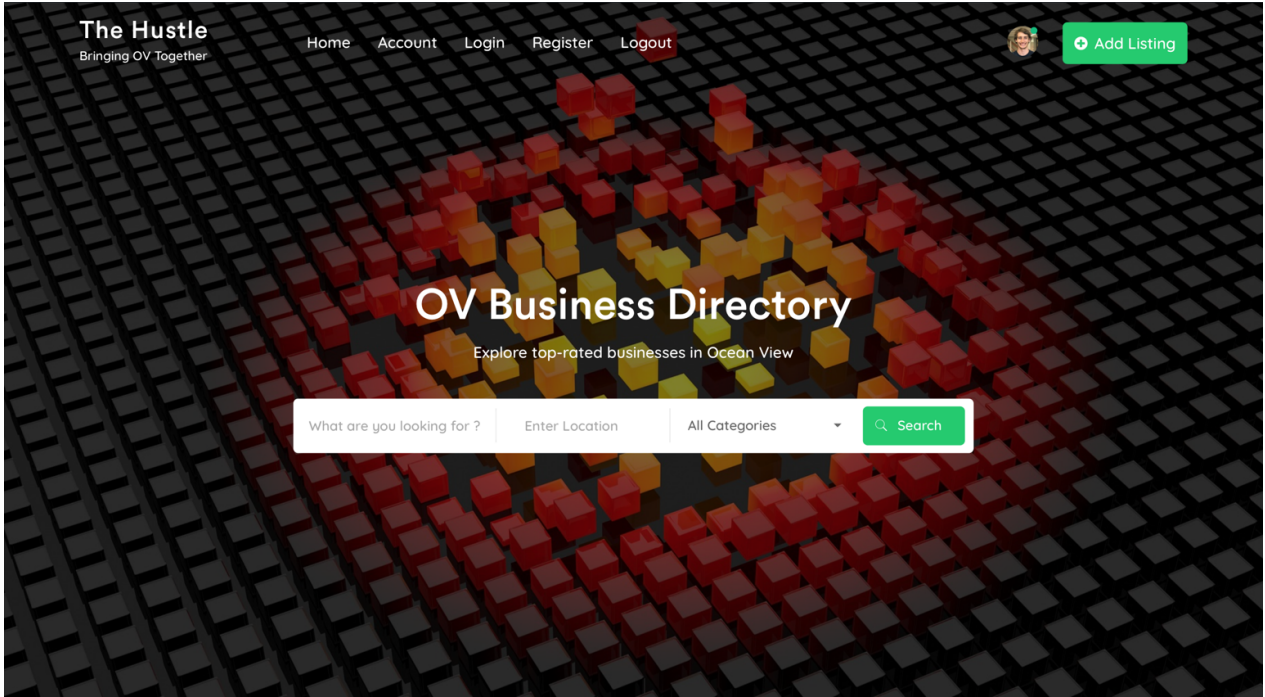|	
Idea Collaboration	Similar to the SE trajectory that this project began on, this feature would enable budding entrepreneurs to post and contribute to business ideas, and, upon connection with the right individuals and resources, to launch a new venture in OV.
Language Translations	This was attempted using the 'Say What?' plug-in, but to no avail. Ranked as low importance as most all residents of Ocean View can functionally read and write in English.

8. ACKNOWLEDGMENTS

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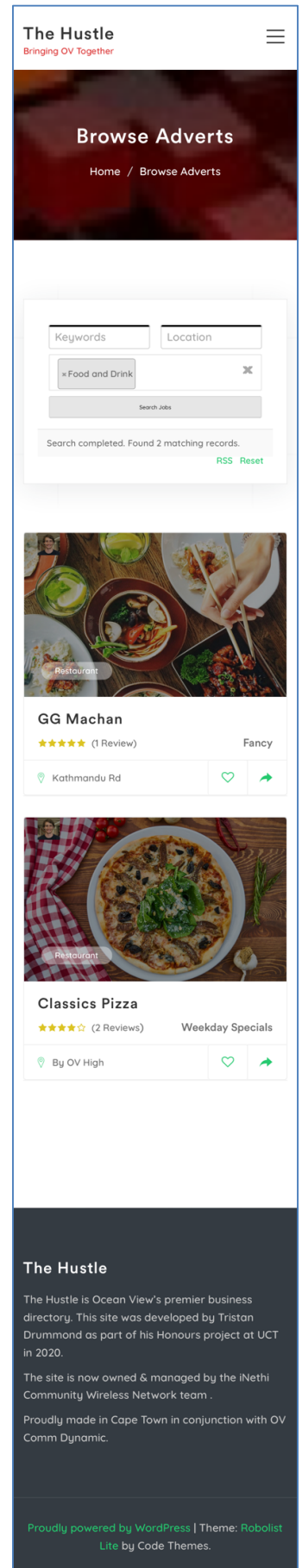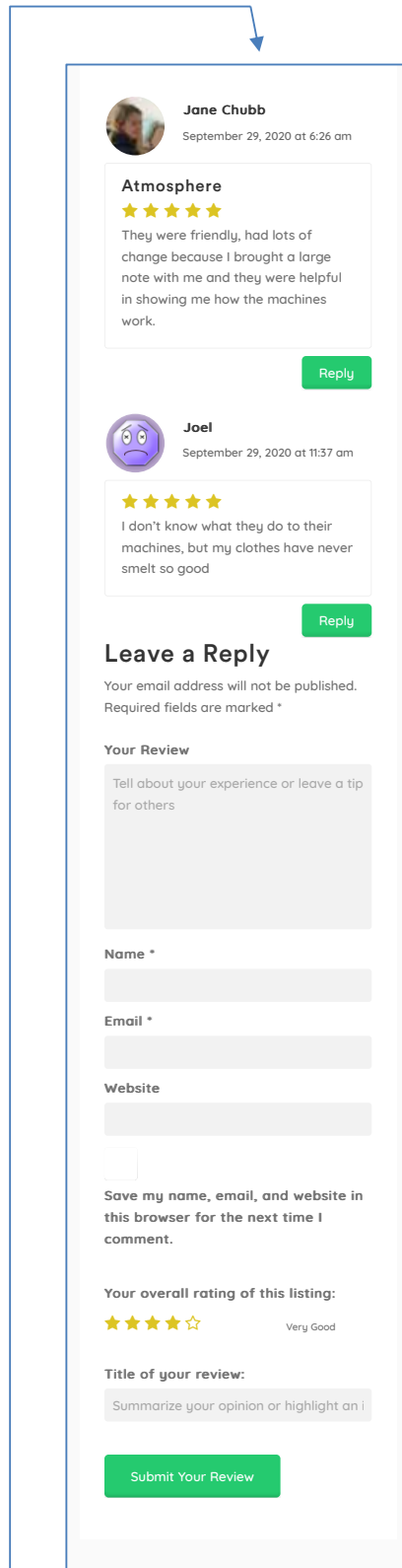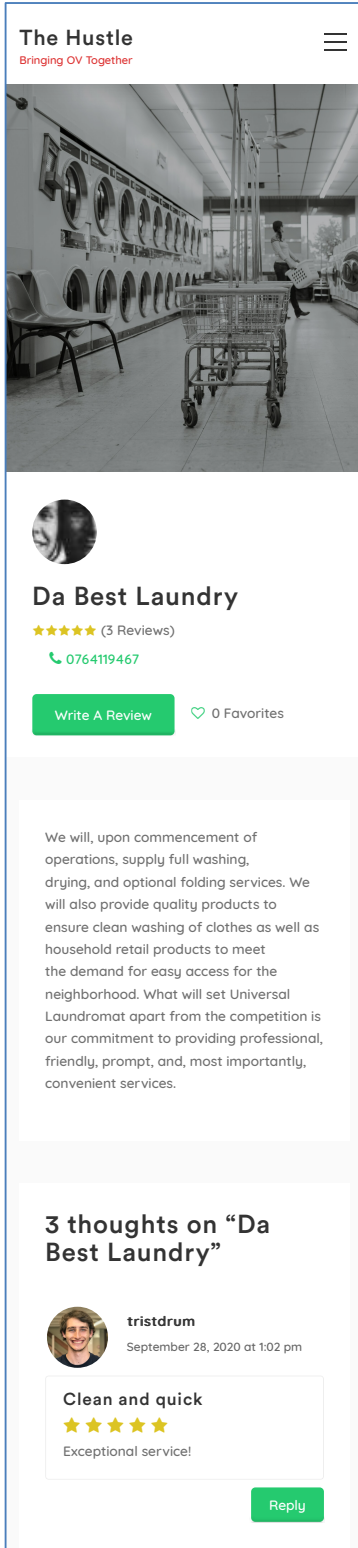
SUPPLEMENTARY INFORMATION

Appendix 1: *The Hustle* **Home Page & Listing Cards**

Appendix 2: *The Hustle* Various Screens on Mobile

The Hustle
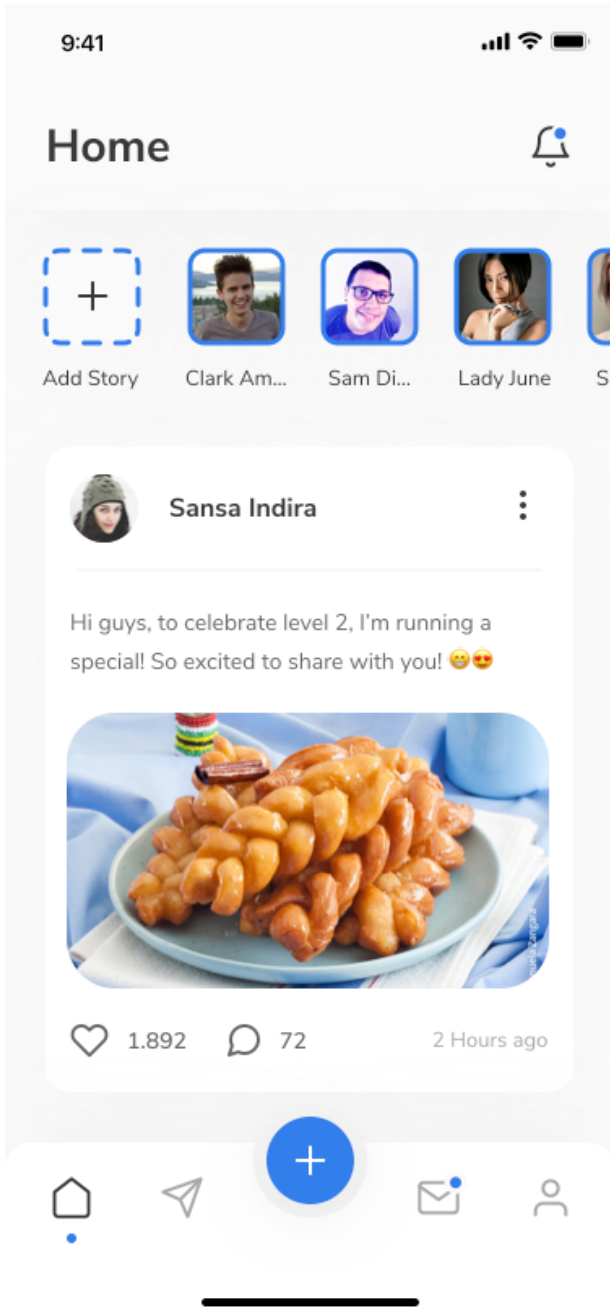Bringing OV Together

Da Best Laundry

★★★★★ (3 Reviews)

📞 0764119467

Write A Review   ♡ 0 Favorites

We will, upon commencement of operations, supply full washing, drying, and optional folding services. We will also provide quality products to ensure clean washing of clothes as well as household retail products to meet the demand for easy access for the neighborhood. What will set Universal Laundromat apart from the competition is our commitment to providing professional, friendly, prompt, and, most importantly, convenient services.

3 thoughts on "Da Best Laundry"

tristdrum
September 28, 2020 at 1:02 pm

Clean and quick
★★★★★
Exceptional service!

Reply

Jane Chubb
September 29, 2020 at 6:26 am

Atmosphere
★★★★★
They were friendly, had lots of change because I brought a large note with me and they were helpful in showing me how the machines work.

Reply

Joel
September 29, 2020 at 11:37 am

★★★★★
I don't know what they do to their machines, but my clothes have never smelt so good

Reply

Leave a Reply

Your email address will not be published. Required fields are marked *

Your Review

Tell about your experience or leave a tip for others

Name *

Email *

Website

Save my name, email, and website in this browser for the next time I comment.

Your overall rating of this listing:

★★★★☆   Very Good

Title of your review:

Summarize your opinion or highlight an i

Submit Your Review

The Hustle
Bringing OV Together

Browse Adverts

Home / Browse Adverts

Keywords   Location

×Food and Drink   ✕

Search Jobs

Search completed. Found 2 matching records.

RSS Reset

GG Machan
★★★★★ (1 Review)   Fancy
📍 Kathmandu Rd   ♡ ↗

Classics Pizza
★★★★☆ (2 Reviews)   Weekday Specials
📍 By OV High   ♡ ↗

The Hustle

The Hustle is Ocean View's premier business directory. This site was developed by Tristan Drummond as part of his Honours project at UCT in 2020.

The site is now owned & managed by the iNethi Community Wireless Network team .

Proudly made in Cape Town in conjunction with OV Comm Dynamic.

Proudly powered by WordPress | Theme: Robolist Lite by Code Themes.

Appendix 3: Interview Questions

Interview Questions   Mon 27 Jul 2020

- Hello, consent, start recording, confirm call details and consent
- Build rappot, ask about them and their business/role in OV economy

- How many informal businesses do you think exist within OV?
- What sort of informal economic activity do you think occurs within OV?
- Current experiences with businesses or entrpeneurs? ie how do people find out about services or business in OV
- what ideas do they have to boost economic activity;
- what ideas do they have to improve the ways in which busineses link to one another and how customers link to businesses
- what are some of the challneges that entreprenuers or business owners face and also what challenges do non businesses people getting services etc or businesses in OV.

- Currently, how do these business owners find out about and collaborate with each other?
    - Do they use social media?
    - How do you think iNethi could better facilitate their interactions?
    - How do you think iNethi could be used to promote economic activity?

- What are some of the most common feelings towards the iNethi system in OV amongst different groups?
    - (looking for group & their emotion if possible)
    - Anger, distrust, resentment, lack of hope? Joy, encouraging, exciting, good?

- Do you know any entrepreneurs/hustlers? (people looking for any opportunities to earn money)
    - Which of them do you think are reliable? Why?
    - Which of them have had relative success? Why?
    - Can we have their contact detail to work with them for the duration of this project?

Then as a way to close of the interview open up opportunities for users to share if they have any suggestions for what you spoke about in general; what are their aspirations for themeselves and the community especially in relation to business and services in OV

Appendix 3: Original Advertisement-Platform Design

Appendix 4: WordPress Database Tables

wp_ms_snippets
- id BIGINT(20)
- name TINYTEXT
- description TEXT
- code LONGTEXT
- tags LONGTEXT
- scope VARCHAR(15)
- priority SMALLINT(6)
- active TINYINT(1)
- modified DATETIME
- Indexes

wp_users
- ID BIGINT(20)
- user_login VARCHAR(60)
- user_pass VARCHAR(255)
- user_nicename VARCHAR(50)
- user_email VARCHAR(100)
- user_url VARCHAR(100)
- user_registered DATETIME
- user_activation_key VARCHAR(255)
- user_status INT(11)
- display_name VARCHAR(250)
- Indexes

wp_options
- option_id BIGINT(20)
- option_name VARCHAR(191)
- option_value LONGTEXT
- autoload VARCHAR(20)
- Indexes

wp_um_metadata
- umeta_id BIGINT(20)
- user_id BIGINT(20)
- um_key VARCHAR(255)
- um_value LONGTEXT
- Indexes

wp_term_relationships
- object_id BIGINT(20)
- term_taxonomy_id BIGINT(20)
- term_order INT(11)
- Indexes

wp_commentmeta
- meta_id BIGINT(20)
- comment_id BIGINT(20)
- meta_key VARCHAR(255)
- meta_value LONGTEXT
- Indexes

wp_terms
- term_id BIGINT(20)
- name VARCHAR(200)
- slug VARCHAR(200)
- term_group BIGINT(10)
- Indexes

wp_usermeta
- umeta_id BIGINT(20)
- user_id BIGINT(20)
- meta_key VARCHAR(255)
- meta_value LONGTEXT
- Indexes

wp_links
- link_id BIGINT(20)
- link_url VARCHAR(255)
- link_name VARCHAR(255)
- link_image VARCHAR(255)
- link_target VARCHAR(25)
- link_description VARCHAR(255)
- link_visible VARCHAR(20)
- link_owner BIGINT(20)
- link_rating INT(11)
- link_updated DATETIME
- link_rel VARCHAR(255)
- link_notes MEDIUMTEXT
- link_rss VARCHAR(255)
- Indexes

wp_postmeta
- meta_id BIGINT(20)
- post_id BIGINT(20)
- meta_key VARCHAR(255)
- meta_value LONGTEXT
- Indexes

wp_term_taxonomy
- term_taxonomy_id BIGINT(20)
- term_id BIGINT(20)
- taxonomy VARCHAR(32)
- description LONGTEXT
- parent BIGINT(20)
- count BIGINT(20)
- Indexes

wp_snippets
- id BIGINT(20)
- name TINYTEXT
- description TEXT
- code LONGTEXT
- tags LONGTEXT
- scope VARCHAR(15)
- priority SMALLINT(6)
- active TINYINT(1)
- modified DATETIME
- Indexes

wp_termmeta
- meta_id BIGINT(20)
- term_id BIGINT(20)
- meta_key VARCHAR(255)
- meta_value LONGTEXT
- Indexes

wp_posts
- ID BIGINT(20)
- post_author BIGINT(20)
- post_date DATETIME
- post_date_gmt DATETIME
- post_content LONGTEXT
- post_title TEXT
- post_excerpt TEXT
- post_status VARCHAR(20)
- comment_status VARCHAR(20)
- ping_status VARCHAR(20)
- post_password VARCHAR(255)
- post_name VARCHAR(200)
- to_ping TEXT
- pinged TEXT
- post_modified DATETIME
- post_modified_gmt DATETIME
- post_content_filtered LONGTEXT
- post_parent BIGINT(20)
- guid VARCHAR(255)
- menu_order INT(11)
- post_type VARCHAR(20)
- post_mime_type VARCHAR(100)
- comment_count BIGINT(20)
- Indexes

wp_comments
- comment_ID BIGINT(20)
- comment_post_ID BIGINT(20)
- comment_author TINYTEXT
- comment_author_email VARCHAR(100)
- comment_author_url VARCHAR(200)
- comment_author_IP VARCHAR(100)
- comment_date DATETIME
- comment_date_gmt DATETIME
- comment_content TEXT
- comment_karma INT(11)
- comment_approved VARCHAR(20)
- comment_agent VARCHAR(255)
- comment_type VARCHAR(20)
- comment_parent BIGINT(20)
- user_id BIGINT(20)
- Indexes

Appendix 5: System Overview (adapted from iNethi Architecture Doc)