

# Facilitating Local Content Sharing and Services on the iNethi Network

## Project Proposal

Tristan Drummond  
Computer Science  
University of Cape Town  
Cape Town, Western Cape,  
South Africa  
[DRMTRI001@myuct.ac.za](mailto:DRMTRI001@myuct.ac.za)

Keegan White  
Computer Science  
University of Cape Town  
Cape Town, Western Cape,  
South Africa  
[WHTKEE004@myuct.ac.za](mailto:WHTKEE004@myuct.ac.za)

## 1 PROJECT DESCRIPTION

The iNethi network is a community-owned wireless network in Ocean View (OV) in Cape Town, South Africa. The system was created to not only offer members of the Ocean View community access to cheaper internet but also encourage content sharing between the people in the 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. It utilises open-source software to share files and to allow people to communicate; this is done using OwnCloud and Diaspora, respectively. [2] The network provides wireless internet over television white spaces and WiFi mesh, which is accessed at WiFi access points. [1] 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.

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 community. 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. [1] 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. This project aims to add features to the iNethi network that the community have identified explicitly as features they are interested in, specifically a music sharing website and an app focussed on connecting entrepreneurs to stimulate economic activity.

These additions to the iNethi network must take bandwidth constraints into account and accommodate for the fact that the majority of users that will be accessing these features will be using feature and smartphones, rather than a computer, as this is the most common means of access to the internet in low-income areas in South Africa. [3, 4, 5, 6, 7]

## 2 PROBLEM STATEMENT AND AIMS

There are two distinct software development deliverables that this project aims to produce. Both deliverables stem from the needs that the community has identified. They are expanded upon below.

### 2.1 Music Sharing on the iNethi Platform

In order to fulfil the need for a way to share locally made music in the OV community, a locally hosted website that makes use of the pre-existing data stores will be developed. The website will communicate with a MongoDB database and store all uploaded media on the iNethi servers using this NoSQL approach.

There are many reasons for this application to be created beyond the fact that it has been requested by the OV community. Music in low-income areas, such as OV, is an important means of communication and a vital tool in challenging racial barriers present in the country post-apartheid. Thus, this is a tool that will not only help the musicians build an audience but will also act as a platform on which this social movement can be built off.

Bandwidth constraints hinder music sharing in low-income areas in South Africa as the majority of global music sharing platforms are predominantly streaming-based, thus making them inaccessible to both listeners and musicians in low-income areas. Thus, a music sharing platform purposely built for the iNethi network would need to be designed to limit data usage. The pre-existing file sharing features on the iNethi network are carried out using a 'drop box' style file store that does not meet the requirements for a music sharing platform, as there is no way to create a reusable, shareable link that can be opened by anyone in order to download the song.

The users would be residents of OV, specifically local musicians and their audience.

### 2.2 Hustling Business Application

The economic activity that takes place in OV is mainly informal. Residents who run informal economic operations have requested the team to develop an app that allows them to collaborate with other SMMEs (Small Medium and Micro Enterprises) in OV. This app, in its purest form, would simply be a directory service.

Research is still needing to be done to determine user requirements, but it is hoped that a form of the Sharing Economy (SE) could be built into the app too.

Technically, this would consist of an instance of an Amazon AWS EC2 machine implemented on the iNethi servers using Docker. An PWA, web or native Android app would be configured to interact with the backend.

An example of how this collaboration might look is if one resident of OV has a sewing machine, and the skills to use it, but does not have any materials or business knowledge. Another OV resident may have come across a mountain of wholesale leather that is cheap and is entrepreneurially minded. Ordinarily, these two would not have the social capital to connect. Hopefully, now they could use the Hustler app to start a handbag business together. The use cases are endless and unstructured. The app must match the informality of current hustling activities to be successful.

Traditionally, SE apps (like Uber and Airbnb) are inaccessible to marginalised communities such as OV. This marginalisation is due to them being designed with different uses cases and excludes OV residents by nature, in every area. Difficulty in signing-up, obtaining verification and continual use all arise because of device limitations, data-usage and physical realities (such as not owning the land they live on). The planned application could allow users to trade in any number of their skills, services and goods; hopefully providing a way for community members to generate extra income.

### **3 PROCEDURES AND METHODS**

Although there will be two separate deliverables, both projects are going to use the same approach to data collection, development and testing.

#### **3.1 Data Collection, User Interaction and Testing**

All interactions with prospective users and any other stakeholders will all be done virtually due to the current COVID-19 pandemic. Initially, the OVCOMM Dynamic directors, the implementing partners in OV that works with the founders of iNethi, will be interviewed to understand the OV and iNethi contexts better. They will be able to identify members of the community that will be willing to be interviewed and have knowledge on the subjects at hand so that the researchers may gain a better perspective on the problems that are going to be solved. While this data collection process does require a significant investment from participants, in the form of their time, there are people that have taken interest in and require the services that will be deployed. These are residents of OV that have established relationships with the iNethi team and have been involved in previous projects or are linked to people that have an established relationship with the OV community. Additionally, the directors are already on-board with the project and funding for interviews has been approved.

All participants will receive a 1 Gb voucher to the iNethi network and R20 airtime for their time and to cover any costs they will incur by engaging in remote interviews. At this stage, it is planned to carry out all interviews with these community members over

WhatsApp, which will be text-based to limit bandwidth usage. Both developers will be recruiting ten participants each, and in time they hope to attract as many interested parties in the community through a snowball effect.

Due to the short timeframe of the project, it will not be feasible to analyse usage statistics in order to test whether the applications are meeting the user's needs and being accepted by the targeted users. Instead, the testing and evaluation of the applications will be qualitative in nature. The core focus of this process will be conducting cognitive walkthroughs in order to discover usability issues and to get an idea of how intuitive the systems are. This sort of feedback will happen as each of the projects progress, as well as once they have been launched. It is well noted that such an approach relies on user opinions about new features, which will contain several levels of bias from the users. However, in the early stages of the project this would be the most feasible approach. Future work would involve tracking and analysing usage statistics.

The continuous qualitative user testing will allow the developers to adjust their features based on empirical evidence and create an awareness of the technical limitations of the prospective users. Additionally, users will be asked for feedback after these walkthroughs in order to discover any further changes they might want or additional features they would like to see.

#### **3.2 Development Methods and Practices**

In order to meet the aims of the project (to design a system that will meet the needs of the Ocean View community; in the form of a music sharing and a business related app that are suited for bandwidth constrained users), a participatory design approach will be taken. Utilising participatory design means that user feedback and input will become part and parcel of the design process. Furthermore, once a feature has been designed, it will be shown to participants and feedback from them will then be considered. The result is that no feature will be finalised without input by prospective users.

An agile approach to software development has been chosen as the iterative nature of this approach will allow prospective users and other stakeholders to have their feedback incorporated into the development process as early as possible to prohibit time wasted on features that are not fundamentally necessary. An agile approach is imperative, as the timeframe of the project is short and does not allow for time to spend exploring avenues that are not of core importance.

At a high level, there will be four phases in the project. Phase one will involve the initial engagement with directors of OVCOMM Dynamic informing them of the project and getting their views on the project. In the second phase, interviews will be conducted with relevant parties, identified by the directors, in order to refine the project and develop a clear understanding of the community's needs. In the third phase, the application development will begin, and prototypes will be tested with participants, and finally, user feedback will be gathered on the final deliverables.

### 3.3 Deployment on iNethi

Both applications will be worked on and tested in a sandbox environment to avoid causing issues on the iNethi network. In order to ensure that both applications will be shippable on the iNethi servers without any major difficulties, Docker containers will be used. Docker allows developers to run their applications on any server as a lightweight, portable and self-sufficient container.

Both deliverables will be independent websites. The actual web development is planned to be carried out using Django, which is a free, open-source Python-based web development framework.

Technical difficulties may be faced because both developers do not have extensive web development knowledge and have never used Docker. Additionally, they have to acquaint themselves with the actual iNethi platform, which will require the assistance of someone with a working knowledge of the project. Coming to terms with the complexities of this system, while being under time pressure, may be a challenge.

## 4 ETHICAL, PROFESSIONAL AND LEGAL ISSUES

Three areas have been identified where potential issues may arise. All three are detailed below. Data Ownership is of primary importance, as all three areas (ethical, professional and legal) converge simultaneously.

### 4.1 Research & Evaluation

Before beginning User Evaluations, the research team is required to obtain Ethics Clearance from the UCT Human Research Ethics Committee. We have factored the time needed to obtain clearance into the Gantt Chart (see Appendix) and aim to begin digital interviews as soon as possible.

All users will be 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 will be obtained by one of three methods depending on circumstances. In all likelihood, the COVID-19 lockdown will prevent in-person contact; thus, the first two methods are non-contact specific.

Most preferably, digital consent will be obtained by sending a PDF to those participants who can provide an e-signature. If this is not possible, consent will either be obtained by participants replying with a thumbs up (👍) or thumbs down (👎) emoji or a simple yes or no on WhatsApp to the three areas requiring consent (participation, permission to record the conversation, permission to use anonymised audio transcriptions) as per the projects Ethics Statement.

If consent is then given, questions will be asked about their lives in OV (in relation to Music and Hustling) and, at a later stage, about both prototypes. Their answers will be recorded, transcribed and analysed. Analysis will comprise of highlighting characteristic and interesting quotes; tagging them based on themes or implications;

grouping, organising and merging tags; and iterating through these steps until there are no new changes in the categorisation of the data. Qualitative analysis software (nVivo) will be used to assist in this process.

For the sake of anonymity, the transcriptions will not bear the names of the interviewees. Any recorded information that the researchers think could be used to identify the individuals will not be documented. The researchers are planning on keeping a separate table recording and allocating pseudonyms or codes to each interviewee.

### 4.2 Data and Code Ownership

This code is owned by UCT (according to its Intellectual Property Policy) [11], and by OVCOMM Dynamic as per previous research partnership norms.

Data generated (such as uploaded songs and business listings) from the applications will be publicly available, and this will be made explicit by each application, however, musicians have mentioned in the past that they wish to make money off of their music so each song will still be owned by the musician.

## 5 RELATED WORK

There are two specific areas which this project will focus on; they are how an ICTs (Information Communication Technologies) could assist in digitising hustling and promoting music sharing in OV. A few papers surrounding each are discussed below.

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. [8] These transactions predominantly take place using digital platforms such as Facebook nowadays. The same study [8] suggests, as logic would have it, that the more successful hustlers have more extensive social networks – in both the virtual and the physical. The potential of such a platform in underemployed communities has been explored in the USA, with results showing promise. [10]

The technology used previously was simple Facebook analytics of marketplace posts for the sharing and exchange of goods. There are no previous and applicable systems that could be mimicked.

Music sharing in low-income areas in South Africa has been dominated by Bluetooth and WhatsApp file sharing. [4, 5] There has only been one attempt to facilitate music sharing in these communities, which resulted in the development of a website called KasiMP3. It was designed for use on feature phones with data constrained users in mind. [5] It allows musicians to create a profile, upload songs, videos, pictures and has many features of a social media website. [5] However, musicians have started having difficulty accessing the site, which is believed to be due to latency issues. [5] In analysing the interviews done related to KasiMP3, it became apparent that the social media features of the website were not necessary, and the artists did not necessarily use the picture and video features. Both of these issues were driven by the fact that the

artists and users are bandwidth constrained. Their main requirement was for a website that allowed for an uncomplicated and data-efficient way to download music.

## **6 ANTICIPATED OUTCOMES**

### **6.1 Expected Impact**

The aim is that each deliverable will be deployed and have a permanent spot on the iNethi servers. It is suspected that initial usage may be low due to not many people in OV knowing about the new applications so to spread the word, the applications can be advertised on the Splash Page of the iNethi network.

The hope is that the applications will be used regularly by a few people who will then encourage others to use them too, therefore allowing both platforms to grow organically. Each deliverable will have a separate system, and their individual expected impacts are explained below.

It is anticipated that the Music Sharing app will promote local music creation and sharing. These activities will hopefully inspire other musicians to create, record and share their music too. Keeping the younger generation occupied with constructive outlets, such as music creation, may keep them out of gangs.

It is anticipated that the Hustling Business App will increase business-oriented connections and collaborations within the community. It is expected for the app to be used for different purposes to those that it was designed for, these activities will likely evolve as more users adopt the apps. The hope is that it will be a useful tool that will gain traction and stimulate economic activity within OV.

### **6.2 Key Success Factors**

The factors by which we will judge whether our projects are successful are largely overlapping, the common factors are first detailed here, while the specific success factors are detailed below.

Firstly, and most importantly, the project can only be defined as successful (in terms of our honour year) if, by the end of the year, both deliverables are live on the iNethi network, fully functioning and running on a day to day basis without any bugs.

Additionally, the project will be considered successful if any number of the users asked to evaluate our final product are planning on using the applications and are going to encourage others in their community to use them too. While this may incorporate obvious bias, there is no other way to gauge the future usage of the applications so this bias should be kept in mind.

There are a few key features that the individual apps hope to deliver. The Music Sharing App must allow musicians to upload and download songs, each song must have a download counter, and each song must have a name field that allows them to appear when searched for on the website.

The Business/Hustling App should allow entrepreneurs to connect with each other and with others in the community. It must allow for

a wide variety of 'listings', anything from skills and services to extra resources.

### **6.3 Systems**

Features will be developed in-line with the requirements of the community. Thus, the below feature sets are not final but are rather speculations made by the researchers as to what might be required. Some challenges that may be faced include the lack of physical interaction between the researchers and the current iNethi team.

It may be difficult to learn how to successfully implement our applications using Docker (the service on which our apps will run on the server) with no physical assistance due to the COVID-19 lockdown. It is foreseen that, due to regular digital meetings with the iNethi team, this challenge may be overcome remotely.

#### **6.3.1 Music Sharing Application**

The final deliverable for this application will be a fully functional website that will allow users to upload and download music in a bandwidth-efficient manner. The core features will be an analytics system for musicians, a tagging system so that the songs are discoverable when the website is searched, and each song will have a page with a link to download the song and a description with the artist's details. In order to be successful, it should become the preferred method of sharing music by the musicians, which can only be seen over a long term but the musicians will be asked about this and again there bias must be taken into account, with them sending links to this website rather than using Bluetooth and WhatsApp to share their media files.

#### **6.3.1 Business Application**

The Business/Hustling App will allow entrepreneurs to connect with each other and others in the community. It will allow for a wide variety of 'listings', anything from skills and services to extra resources. The app will try to implement enough of a structure to the 'listings' to inspire entrepreneurial thinking around what could earn the user extra income, but not too invasive a structure as to eliminate the variety of trading and collaboration that could (and does currently) exist informally in OV.

## **7 PROJECT PLAN**

### **7.1 Risks & Management Strategies.**

This project is low risk, and the initial engagements with OVCOMM Dynamic will help flesh out and identify further risks and their respective mitigation strategies. See Appendix A for the full table.

### **7.2 Timeline**

The project runs from early April 2020, when the literature reviews began, until 19 October 2020. See Appendix B for a full Gantt chart.

### **7.3 Resources required**

Thankfully, the resources needed to complete this project are minimally affected by the COVID-19 lockdown. Software and

community knowledge are the only significant resources (alongside time) that are needed to complete this project.

The software required is freely available or has been purchased on our behalf by the UCT/iNethi team. The two systems to be worked on are the Amazon Web Services platform (utilising EC2 virtual machines) and Docker (containerisation of apps to be run on the iNethi server). Both researchers are in the process of upskilling themselves for these platforms, but ample support is available from their supervisors and the rest of the iNethi team. They are confident of their ability to implement their relevant applications successfully using the required tech stack.

The people of OV are probably the most important resource for this project and, although the lockdown has posed challenges to communication, OVCOMM Dynamic has agreed to help researchers gain the needed (digital) access to the community. As such, adapted methods of interviewing residents, gathering data and evaluating prototypes have been planned for and have been discussed previously.

## 7.4 Deliverables

There are two main deliverables for the project, a music sharing application and a hustling business application with the features that are specified in section 6.3. The following is not a definitive list of features as a participatory approach is being taken to design, and once the prospective users have been interviewed, some features may be removed, and new ones may be added. The other deliverables are as follows:

- The literature reviews
- The project proposal
- Software Feasibility Demonstration
- The project website
- The project poster
- The final reports

## 7.5 Milestones

The milestones for this project are presented in the Gantt chart (see Appendix B) and Tasks and Milestones table (see Appendix C). Other than the project deliverables, there are also development milestones added that both developers are planning on abiding by.

## 7.6 Work Allocation

Because there are two separate deliverables, each partner will tackle one. Tristan will be creating the hustling business application, and Keegan will be creating the music-sharing application. The interview process, user feedback sessions and all aspects of the development process will be carried out individually.

## ACKNOWLEDGEMENTS

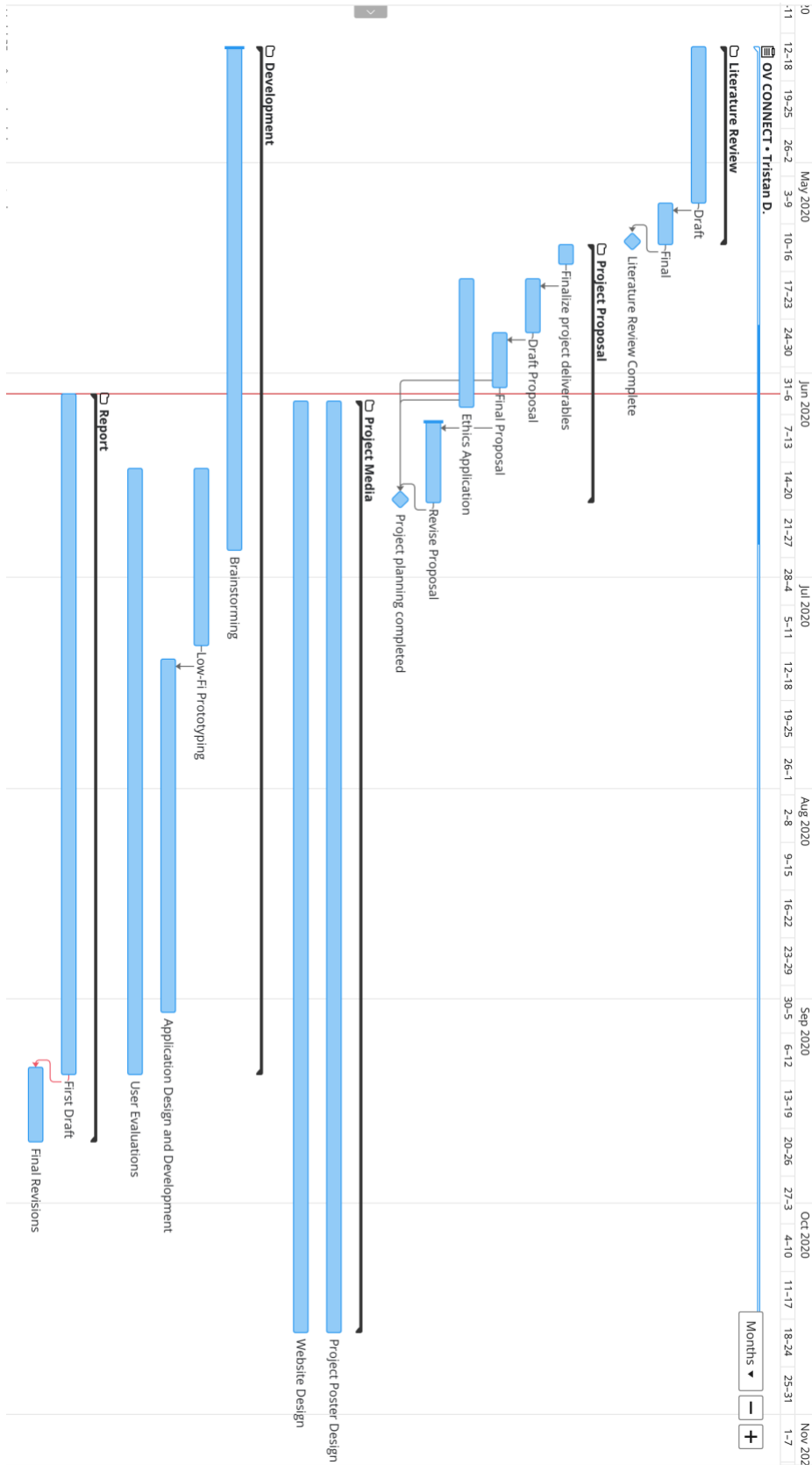
## REFERENCES

- [1] M. Lorini, M. Densmore, J. David S. Hadzic, H. Mthoko, G. Manuel, M. Waries and A. van Zyl. 2019. *Localize-It: Co-designing a Community-Owned Platform*. *Locally Relevant ICT Research*, 1-15. DOI: [10.1007/978-3-030-11235-6\\_16](https://doi.org/10.1007/978-3-030-11235-6_16)
- [2] A. Phokeer, M. Densmore and D. Johnson. 2016. *Characterisation of Mobile Data Usage in Township Communities*. *Proceedings of Southern Africa Telecommunication Networks and Applications Conference*, DOI: [10.13140/RG.2.2.36137.80486](https://doi.org/10.13140/RG.2.2.36137.80486)
- [3] T. Kreutzer. 2009. *Assessing cell phone usage in a South African township school*. *Int. J. Educ. Dev. Using Inf. Commun. Technol.*, vol. 5, no. 5 (2009), 43– 57.
- [4] A. Schoon. 2014. *Digital hustling: ICT practices of hip-hop artists in Grahamstown*. *Technoetic Arts a Journal of Speculative Research*, 12 (2014), 207-217. DOI: [10.1386/tear.12.2-3.207\\_1](https://doi.org/10.1386/tear.12.2-3.207_1)
- [5] A. Schoon. 2016. *Distributing hip-hop in a South African town: from the digital backyard studio to the translocal ghetto internet*. In *Proceedings of the First African Conference on Human Computer Interaction*, 104-113. DOI: <https://doi.org/10.1145/2998581.2998592>
- [6] S. Hadzic, A. Phokeer and D. Johnson. 2016. *Townshipnet: a localised hybrid TVWS-WiFi and cloud services network*. *International Symposium on Technology and Society*, 1-6.
- [7] I. de Lanerolle. 2012. *The New Wave: Who connects to the Internet in South Africa, HOW they connect and what they do when they connect*. DOI: [10.13140/2.1.1391.6485](https://doi.org/10.13140/2.1.1391.6485).
- [8] Susan Wyche, Andrea Forte, and Sarita Yardi Schoenebeck. 2013. *Hustling Online: Understanding Consolidated Facebook Use in an Informal Settlement in Nairobi*. *CHI*: 2823.
- [9] A. Phokeer, M. Densmore, D. Johnson, and N. Feamster. 2016. *A First Look at Mobile Internet Use in Township Communities in South Africa*. *ACM DEV '16: Proceedings of the 7th Annual Symposium on Computing for Development*, 15 (2016), 1-10. DOI: <https://doi.org/10.1145/3001913.3001926>
- [10] T. Dillahunt and A. Malone. 2015. *The Promise of the Sharing Economy among Disadvantaged Communities*. *Acm CHI 2015*, 2285–2294. DOI: [10.1145/2702123.2702189](https://doi.org/10.1145/2702123.2702189)
- [11] University of Cape Town. 2011. *Intellectual Property Policy*.

## APPENDIX A (RISK MATRIX)

Risk	Probability	Impact	Consequence	Mitigation
Communication difficulties due to remote interactions due to the COVID-19 lockdown.	High	Low	Misunderstandings may occur, which could result in a poor understanding of the OV context, and the residents desired solutions.	Slightly more nuanced methods of interaction are required. Listening for longer, asking better questions (ones that are simpler, shorter and open-ended; that encourage divergent and descriptive answers)
Building high expectations in the community that might not come to fruition.	Moderate	Moderate	Sowing seeds of mistrust within the community towards researchers that may negatively affect future work with OV resident.	The researchers aim to be very clear upfront about the duration and commitment of their involvement with iNethi. No promises of any software being developed will be made. The nature of the honours project requires disclosure that, come the end of the year, the applications will be handed over to OVCOMM Dynamic for maintenance and further development.
The researchers not managing their time effectively, and, thus, not completing the software artefacts in-time.	Low	High	Potentially a failed Honours year.	The researchers have a fantastic support system around them, including mutual accountability and supervisor guidance. Analysing the problem quickly, ideating the minimum viable solution to the problem, breaking up goals into smaller tasks, and working according to a consistent schedule are their chosen mitigation strategies.
Researchers are not able to visit OV to physically evaluate/demonstrate their prototypes/apps due to an extended COVID lockdown.	High	Moderate	Difficulty in performing user-evaluations on prototypes. Likely minimisation in usage due to lower enthusiasm.	Innovative thinking is needed to successfully test early (and often low fidelity) prototype designs without physically being present. Thankfully, the UCT HCI community has already compiled a lengthy document suggesting ways to effectively carry out research in a lockdown environment. The plan would be to focus on more descriptive communication, utilise photos of basic prototypes that can be shared over WhatsApp.
A researcher has to drop the course, negatively affecting the other from completing their part of the project.	Low	Low	A resulting lack of teamwork, accountability and engagement for the remaining researcher.	Due to the reasons behind this risk unfolding being nearly impossible to foresee, the mitigation strategy is too, neigh on impossible. Maintaining good channels of communication surrounding mental health and other, primary issues is the best that can be done.
Research participants not willing to engage with researchers	Low	High	There will be no way to know what OV community members want and due to that the deliverables will not meet the needs of the community.	Rely more heavily on secondary information sources such as the papers referenced in the related works section.

**APPENDIX B (GANTT CHART)**



## APPENDIX C (TASKS AND MILESTONES)

Tasks and Milestones		
Task/Milestone	Start Date	End Date
<b>Literature Review</b>	<b>14/04/2020</b>	<b>12/05/2020</b>
- Draft	14/04/2020	06/05/2020
- Final	07/05/2020	12/05/2020
<b>Project Proposal</b>	<b>13/05/2020</b>	<b>19/06/2020</b>
- Finalise Project Deliverables	13/05/2020	15/05/2020
- Draft Proposal	18/05/2020	25/05/2020
- Final Proposal	26/05/2020	02/06/2020
- Ethics Application	18/05/2020	05/06/2020
- Revise Proposal	08/06/2020	19/06/2020
<b>Project Media</b>	<b>05/06/2020</b>	<b>19/10/2020</b>
- Project Poster Design	05/06/2020	19/10/2020
- Website Design	05/06/2020	19/10/2020
<b>Development</b>	<b>14/04/2020</b>	<b>11/9/2020</b>
- Brainstorming	14/04/2020	26/06/2020
- Low-Fi Prototyping	15/06/2020	10/07/2020
- Application Design and Development	13/07/2020	2/9/2020
- User Evaluations	15/06/2020	11/9/2020
<b>Report</b>	<b>04/06/2020</b>	<b>16/11/2020</b>
- First Draft	04/06/2020	11/09/2020
- Final Revisions	09/11/2020	21/9/2020