

Report

The Network Team

Sristi Summer School 2019

Team Members:

Sumedh Supe (IIITDM Jabalpur)

Anjali Maurya (Premlila Vithaldas Polytechnic, SNDTWU, Mumbai)

Amar Gosavi (GHARDA INSTITUTE OF TECHNOLOGY, LVEL)

Ketan Jailkar (GHARDA INSTITUTE OF TECHNOLOGY, LVEL)

Saumay Garg (Jaypee No Idea)

Omsfree Dalvi (GHARDA INSTITUTE OF TECHNOLOGY, LVEL)

Introduction

Initially as the problem was presented to us, we focused on solving the network issues that most highly remote areas faced. Network issues like a dead network region at places where people had the means to use it but the network couldn't reach them. This issue was quite an important one because it prevented people from accessing resources that were openly available to others on the network. And moreover, in case of an emergency it became quite difficult to quickly relay messages over. Our team wanted these people to establish a contact with the outside world any time they wanted, to at least get help during emergencies. We were given a chance to analyse the salt farmers of the Little Rann of Kutch.

Upon analyzing the problem and visiting the insides of the Little Rann of Kutch ourselves we realized that gaining access to a cellular network was not difficult. People with phones could easily use them to contact people in the Rann during emergencies. But we realized that it was difficult to gain access to high speed internet in the Rann of Kutch.

An organisation providing free healthcare facilities in the Kutch villages needed high speed internet in the Rann to facilitate telemedicine via videoconferencing over the network. And it's unavailability in the Rann excluded many Agariyas from gaining access to quality healthcare facilities during the salt farming season.

Over the course of our visits and interacting with even more people realised that along with this the



Figure 1: Aarogya Kendra

people living in the Rann (Agariyas) faced another problem of making outsiders reach their homes in the Rann. This was especially important for 108 ambulances in the Rann region which faced a lot of problems due to the unavailability of a proper map or navigation data for the drivers. The ambulances had to be accompanied by a locallite living in the Kutch villages to be driven inside the Rann.

The team finally decided to work to extend SETU's network in the Rann and also at the same time try to ease the navigation problem in the Rann region.

We had to focus on whether we had to provide the people with the access to the network or the organisation initially. We had a lot of thought put in, a lot of discussions and meetings with the people themselves. Finally it was decided to work for the organisation SETU. Our major aim was to improve the lives of the Agariyas and through this organisation we could do it, even if it was indirectly. The navigation issue too did not involve the Agariyas directly as they knew their terrain well, it was for the outsiders to easily navigate into the Rann indirectly benefiting the Agariya people again.

Field Visit Observations and Insights

Initially we were focused on mapping all the factors that could have an impact on our solution. We had none as of then but had a few key pieces of info that we were looking for.

While visiting the Rann and meeting the salt farmers

During our initial field visit to the Rann and interviewing the people the following revelations came up.

The Little Rann of Kutch was a wildlife sanctuary where nothing concrete could be ever built due to the



Figure 2: Interviewing the people of kharaghoda

strict regulations. Even the houses of the Agariyas were temporary. The only concrete things visible were temple like structures with tall trishuls and metal structures, attached with them. We realised that the salt farmers carried many sims with them, mostly all if possible, with Jio and Idea-Vodafone sims having the most preference. Network in the deeper Rann was mostly fit enough for calls.



Figure 3: The visible concrete things (Trishul and Mandir)

The medical treatment of the people living in Kharaghoda village is dependent on mainly two sources, one is the government clinic situated in a village situated 7 km away named 'Patdi' which is more commonly used in cases where treatment needs the doctor to be physically present (like a bone fracture). They also use the services of SETU (a charitable trust that provides free healthcare facilities ranging from medicines to telemedicine services via videoconferencing), they had been helped by the service. This service truck/van goes to places in the village where a receiver is pre-installed and the doctor diagnoses via internet, the medicines are prescribed using a number system having unique association with medicines. They also provide small tests, this service however can't reach the remote areas due to absence of any receiver or amplifier in between. The solution Ambubhai (The person in charge at SETU) wanted was to have an antenna attached to the truck to carry the regular receiver. We also realised Ambubhai had studied Chemistry at college and wanted help with the technicalities of the situation.



Figure 4: Telemedicine VAN

The salt farmers carry their TVs with them every time they visit the Rann (not all families) but they do carry certain means for entertainment. There they use the DD Free Dish D2H service, which runs really well throughout the Rann of Kutch.

When asked if the kids used the Swayam channels on DD free-dish (which provide quality education via TV) to study, we got a blank response as if that the people didn't bother much about educating their kids through TV. But they did know about the channels because they clearly are aware of which channels have disappeared and have come back to the Free dish service. (They talked about how Zee TV was no longer available.)

Navigation in Kutch is challenging and people therefore avoid travelling alone at night out of the fear of getting lost. One technique deployed by them for landmarks in the barren desert is the use of temples scattered everywhere and colored red and white flags. It was also observed that people from the outside had difficulty locating houses. If the people had to call an ambulance in the Rann, it would reach them if a localite was in the ambulance or if the ambulance knew their coordinates (which was not the case). The people generally had to carry the ill on bikes in case of emergencies.

Once it was decided that the team was working on extending the reach of SETU in the Rann, it was also found out that Ambubhai didn't want to cover the entire Rann region as he was incapable of handling



Figure 5: Technique deployed by agariya's for landmarks in the barren desert such a huge region. The project of SETU was relatively new and Ambubhai didn't know how people would react to his service in the Rann, so initially he just wanted to cover around 15-20 kilometres inside the Rann from Kharaghoda where SETU has its office.

Meeting the ISP and analysing the existing network SETU was using

We were unsure as to what network SETU was using and to get more insights about the network and to find newer methods provide SETU the high bandwidth internet in the Rann we decided to meet the ISP of SETU, NetGuru at its head office at Mandal. There the ISP explained to us that SETU currently had been using Point to Point connections to connect the villages it was serving. He also explained that at the current infrastructure it would be difficult to just randomly take a receiver inside the Rann. Changes had to be made at the transmission side and he suggested adding a sector to the current tower at SETU.



Figure 6: Currently used Point to Point connection in villages

On visiting SETU, we found out that almost always at least 4 people were there to ferry the van to the nearby villages to provide telemedicine services. The people operating the van didn't have much educational qualifications (highest was till the 12th class), but could operate most of the equipment of the van. The telemedicine van was equipped with a flatscreen TV, a wifi router for an internal network, a chromecast device to make the TV smart (for Skype), battery to run everything (including powering the stationary antenna receivers at the villages). SETU van was fully self-sufficient on power and used the power from their batteries only to power all the networking equipment. It got its batteries charged as soon as the OPD trip was done in the village.

SETU already had a fixed leased line of 4Mbps and consumed way over 4000GBs of data within 2 months. It also paid 80000 rupees for the service and received free of cost maintenance of the local receivers by the ISP.



Figure 7: Equipment's used in Telemedicine van for Network connection

Meeting with SAC ISRO senior advisor

The team also met Dr. Tapan Mishra, whom when asked about the unavailability of high speed internet in the Rann for facilitating telemedicine(via videoconferencing) suggested to modify the healthcare van like

the media OB van and instead of using a sector prefer a satellite internet connection. A satellite connection will be more efficient, as it would provide for the health care van to traverse the entire Rann region as compared to the 25 kilometers proposed by the present solution. When we asked him who would actually be providing the van the internet connection he agreed to give a free 2 Mbps satellite internet connection for free as a donation from ISRO. To discuss the technicalities, Dr. Tapan fixed for a meeting of a technical expert with Prof. Anil Gupta.

We also mentioned about the navigation problem for outsiders in the Rann region, especially the 108 ambulances that had to wait for a local to get the ambulance inside the Rann. And as a solution for this problem on our level without utilizing much resources, he suggested us to pin the different areas of Rann utilizing the phone GPS module, gather the coordinates via Google Maps and then update them individually on Google Maps, to at least map the entire region in reference to the local village clusters in the Rann. This data could then be utilized by the ambulance drivers in case of an emergency to quickly go inside the Rann.



Figure 8: Visit to ISRO

Brainstorming and initial literature review

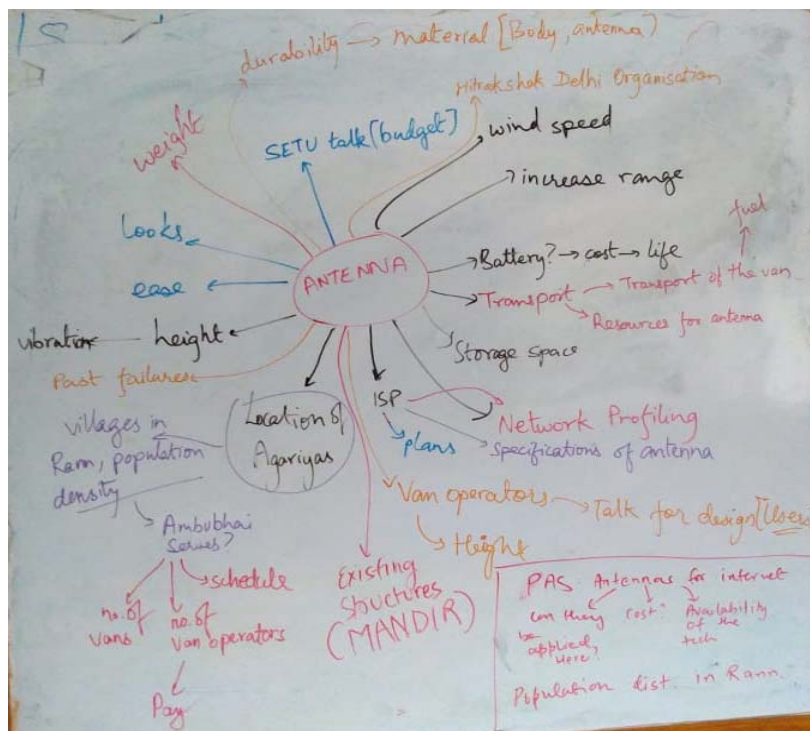


Figure 9: Brainstorming and initial literature review

When we encountered the SETU problem we realised that it was just not the network that was the problem. The main goal of SETU was to provide quality healthcare to every Agariya.

We decided to take a broader view try to solve the problem

So why couldn't SETU just hire an amazing Doctor to treat patient?

It didn't have enough money to do. The video conferencing model required less money and plus doctors also offered their services for free at times.

Plus, there were very less facilities in Kharaghoda for doctors to actually come to live there. They were quite unwilling to live in such a remote location.

Could we helicopter the docs? No...it was expensive again.

SETU had already figured out much of the details and had finally agreed to use the video conferencing model.

So now the question was how can we take the network in Kutch?

SETU already had a fixed line, we just had to extend it wirelessly.

The minimum requirements for download and upload for an HD video conference in Skype is 1.2 Mbps. So now we had to find technology that could enable us to wirelessly transfer data both ways with a minimum bandwidth as mentioned above.

SETU had a budget of around 30,000-40,000 INR, and after having talked with the ISP, the costs incurred with technology (Sector) available with it were estimated at a much lesser cost. So now on a side hand we just had to relay the ISP to the Rann.

In the Rann, the problem was where to mount the receiver?

The Rann is a wildlife sanctuary, protected by laws. Building concrete structures on it is illegal. Plus if we had individual receivers mounted in certain places of the Rann, a lot more maintenance would have been required. It was decided to fix the antenna on the van itself. For it would then be mobile.

We needed an experimental setup of the sector before we could proceed with the experimentation for the mount. The mounts found online were also budget friendly and efficient.

But could we reduce the cost a bit more?

Talks were up with ISRO and they have also agreed to give a fixed 2 Mbps satellite internet link for free. Now to deal with the technicalities, a meeting has yet to be scheduled.

We also found references to other networking solutions, because the present solution on the work requires amount of around 10ft or more. Could there be a solution without a mount?

Finalising the problem statement

Upon due deliberation and team effort we found out that it was necessary to cover the navigation issue too as the network issue seemed pretty close towards a solution and now just required a push from both sides.

The final problem statement:

To help SETU(a charitable trust working to provide free healthcare facilities in Kutch via video conferencing) increase its high bandwidth internet region in the Little Rann of Kutch to provide internet powered health services, awareness programmes etc. AND facilitate easier navigation in the Rann of Kutch for outsiders.

User Involvement

SETU was involved in providing us with so many insights and it was the only user that would actually use the solution.

Ambubhai was a bit glad that at least we could move forward and have a concrete plan to do things. We forwarded him the quotation and have collected enough data for the Sristi team to take over.

The Navigation Problem: A highlight

Originally we were supposed to work on the networking issue but upon seeing the navigation issue as a core one, and upon finding a probable solution to it. We set to implement it.

The issue is actually with the local village clusters in the Rann not being mapped for the outside world. The people (localites) in the Rann region have their own landmarks and methods to navigate the area, but for an outsider it would be a complete disaster going alone into the Rann. The same problem is persistent with the 108 ambulances. There is always a need for a localite to be in the ambulance to drive it into the

Rann. Upon asking many 108 ambulance drivers we realized that they didn't really know the Rann region even if they belonged to the local Kutch region.

Ambubhai had already prepared a map from his side naming all the villages of the Rann. According to

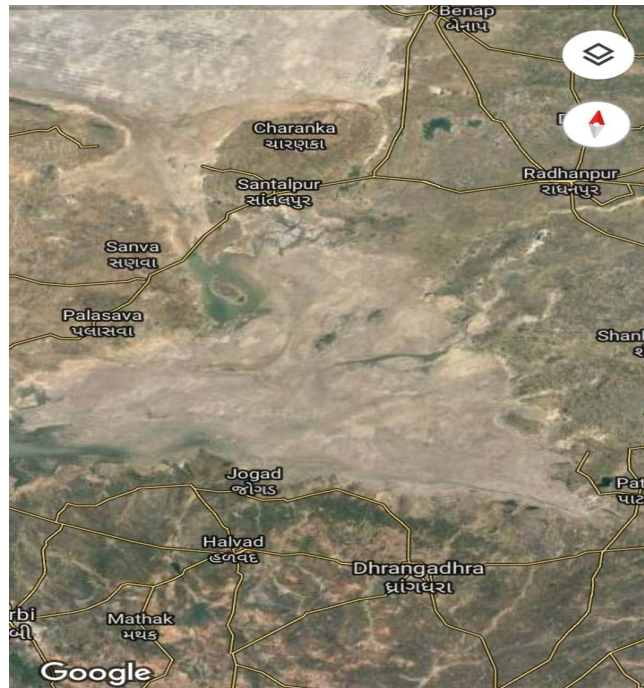


Figure 10: Existing Google map showing Little Rann of Kutch

him it was the first mapping of the Rann of its kind. We verified the Map upon interacting with the locals and asking them about their villages and their locations from other villages.

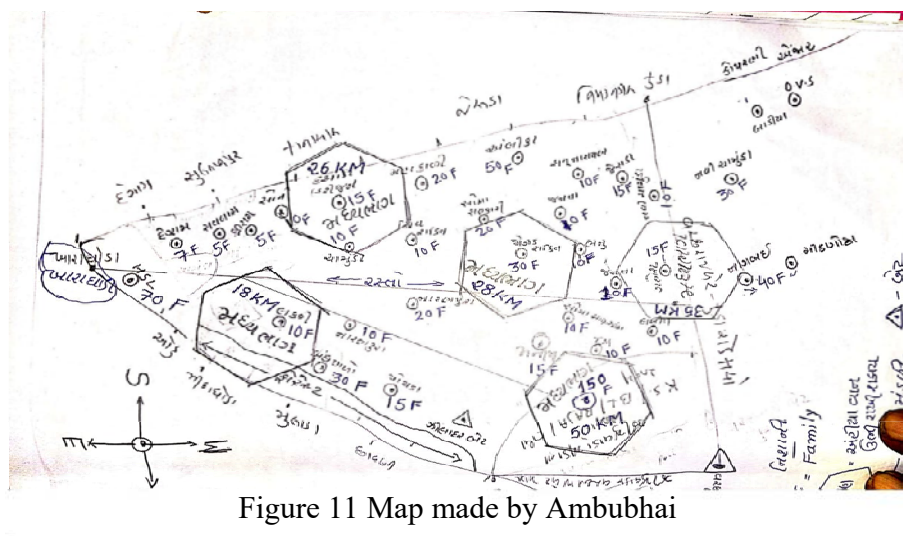


Figure 11 Map made by Ambubhai

One solution that we came up with was to actually go to each and every mapped village with a local with a highly accurate GPS module and note the coordinates to be later updated on a publically updateable map. Here we were trying to update the coordinates on the Google Maps.

We could not actually implement this solution as the weather played a spoilt sport and we could not actually traverse the Rann due to the marshy lands.

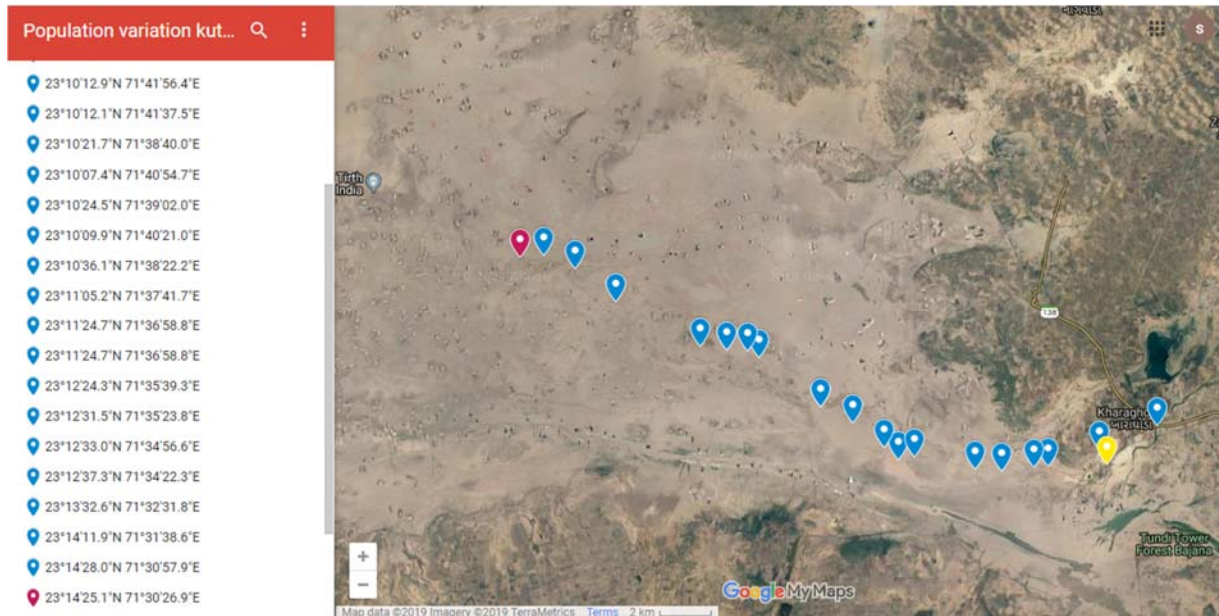


Figure 12: Location marked by us using Google map