

Jawhar visit for hamlet survey and network deployment

18th to 21st November 2019 | Pathardi, Jawhar

In this report, we will discuss the hamlet survey and the deployment of both online and offline networks which was undertaken in Pathardi Gram Panchayat, Jawhar from the 18th of November till the 21st November 2019. The report is divided into different sections and each section will deal with the activity related to that section. The initial sections share a background of the work undertaken and the later part focuses on the accomplishments during the visit.

Radio Frequency planning

In order to undertake deployment of internet connectivity-related network, radio frequency (RF) planning is very essential. Radio Frequency Planning is a step by step procedure to assign transmitter and receiver locations and parameters of wireless network. -

Planning of the network is accomplished through a series of phases. These phases are inter-related and iterative.

Preplanning Phase: This phase involves the determination of sites and their network requirements. Site identification for network setup depends on following primary factors:

- Presence of power for tower and equipment setup.
- Presence of power backup modes such as solar or wind power, in case of main power failure.
- Presence of secure premises for setup.

The general information about the existing towers and network coverage, if any, are gathered to estimate the network requirements of the sites.

The location of existing towers or solar lamps (to power devices like Raspberry Pi) were identified through NoteCam app in which the photo of the probable location is captured along with latitude, longitude, altitude as well as description about the location. Further, the internet speed at that location is tested using fast.com (Figure 1).

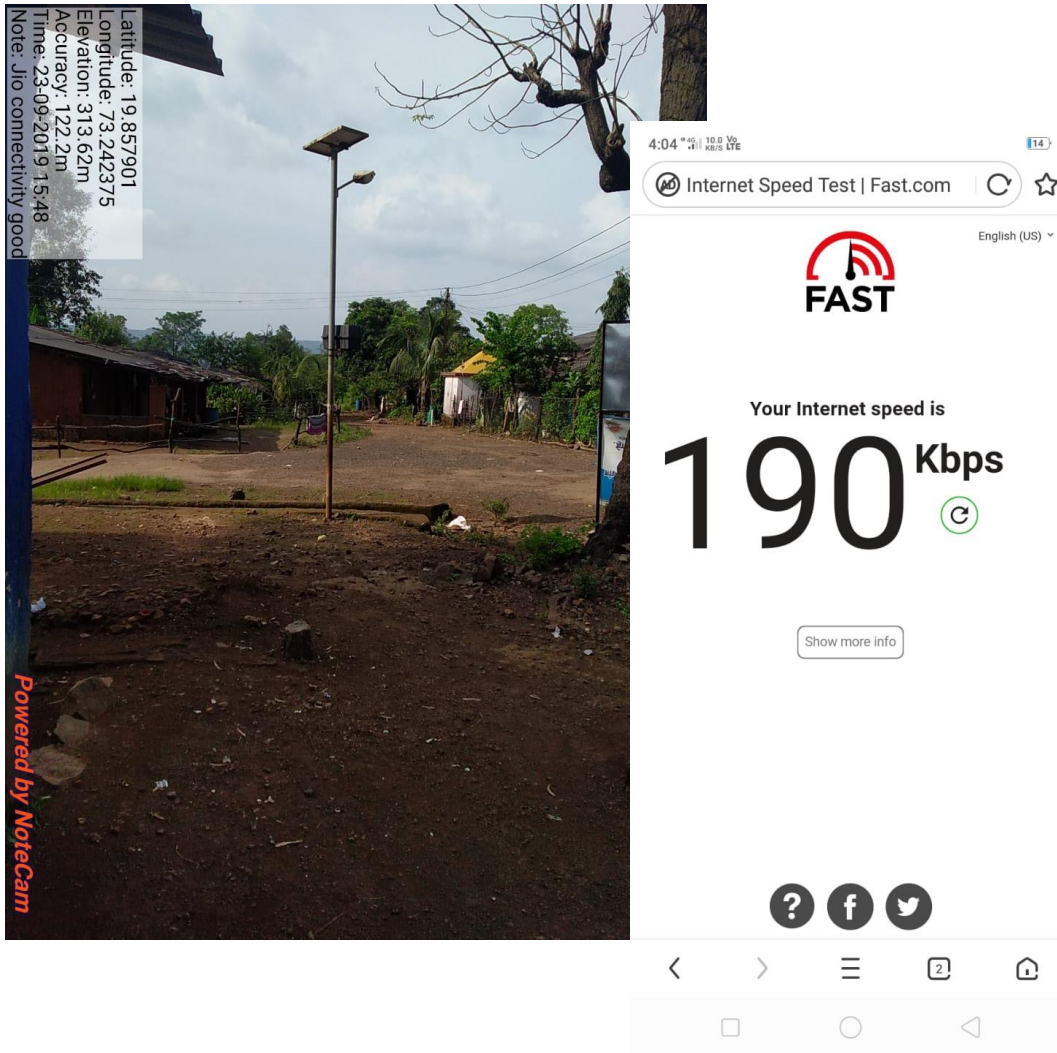


Figure 1: Location details captured using NoteCam app and the internet speed at the location measured through fast.com.

The location information gathered through NoteCam was plotted in Google MyMaps (Figure 2).

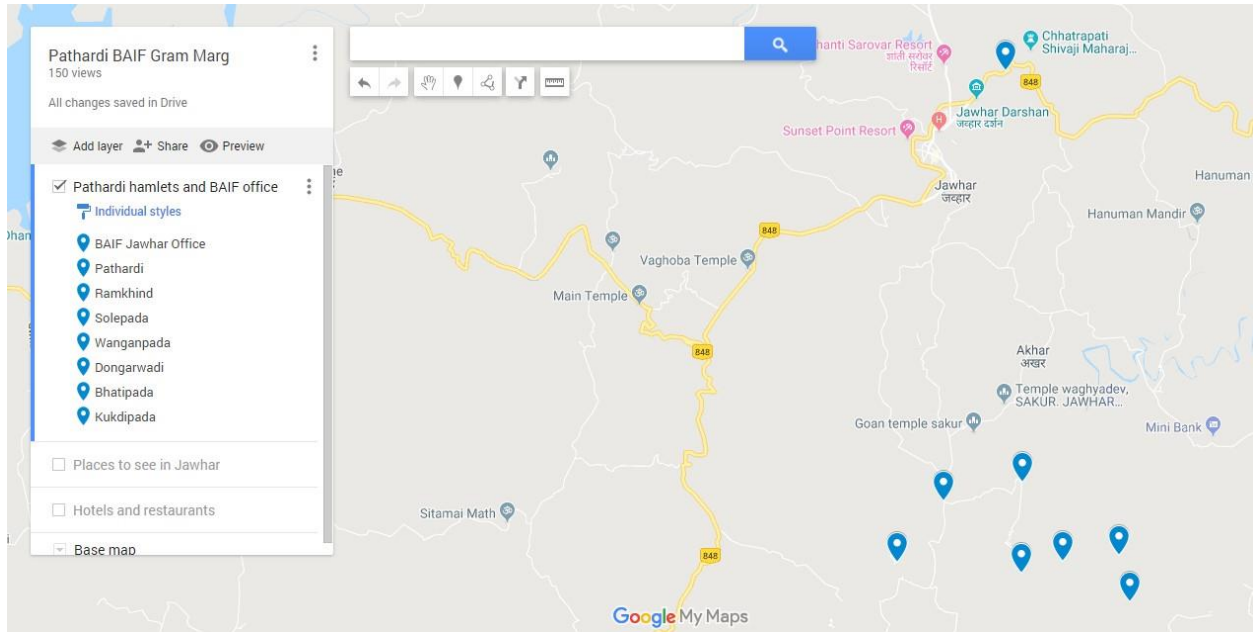


Figure 2: Preliminary locations identified have been plotted on Google My Maps before Site survey.

This information gathered is validated on field in the site survey phase.

Site survey phase

The primary purpose of site survey is to determine the number and exact locations of the base stations necessary to provide network connectivity to the target sites.

Site Survey determines

- topographical properties of the site
- foliage depth in the area
- Obstructions such as hills, cliffs, buildings
- Electrical requirements of the site such as power backup
- Security of the equipment
- Site Survey in the later stages of network establishment process also helps in:
 - Digital maps validations
 - Site feasibility validations as per the theoretical calculations

The outputs of the site survey phase will act as the input for the network planning phase. The exact locations of base stations and receiver along with the terrain between them, will be taken as input parameters in network planning phase.

Deployment of the network

1. Deployment of the online and offline network in Pathardi, Jawhar has been one of the most important activities in the APC project.
2. Radio frequency planning of Pathardi village showed that the village is divided into 5 padas or hamlets. We took the geo-location of these hamlets and checked the mobile signal strength in each of the hamlets.
3. Village survey of Pathardi and the hamlets showed that there are two towers of height 15 meters located in Pathardi and Ramkhind hamlets respectively. These towers are de-functional. It has been decided to use these towers and set up one new 9 meter tower in Solepada.
4. The geo-location of these towers were taken into account for working on the network architecture.
5. The geolocations were fed into Google maps. An overall picture of Pathardi village showed that Pathardi hamlet is approximately centrally located and easily accessible from the different hamlets. Thus it was decided to make Pathardi hamlet as the central node of the connectivity network.
6. The mobile signal strength results showed that the signals are feeble in most part of Pathardi village, while in certain spots, the signal strength was good. We also did a detailed survey of mobile signal strength across different telecom operators.
7. Results of the village survey showed that due to such connectivity, there is no Common Service Center (CSC) in Pathardi. Thus villagers had to travel 12 kms either by bus or walk to Jawhar city for any E Governance related services. The eGovernance services are the ones like issuing birth certificate, death certificate, caste certificate, Aadhaar card etc. Also other services like mobile phone recharge, paying electricity bill is done by travelling to Jawhar city.
8. Due to no connectivity, Pathardi does not have a bank as well. Thus, in order to withdraw money from the bank, deposit money and check bank balance, people need to travel to Jawhar city.
9. It was calculated that on an average people travel to the city 5 times in a month to avail E Governance related activities and banking facilities. In each visit, they spend approx. Rs 100-Rs 120. Sometimes, this cost can increase to Rs 200 also.
10. Community interactions and meetings suggested that Pathardi needed internet connectivity. The connectivity was needed to help people in Pathardi to avail of the E Governance services and banking facilities in the village itself and save money.
11. The other requirement of the people in Pathardi village was to be able to earn money from online network connectivity.
12. The community is also keen to use offline connectivity. There is a great need for offline based talking application.
13. It was discussed with the people in the village about how they would use the offline network. Sharing local knowledge was one of the ways by which the offline network could be used. As Pathardi has indigenous Warli tribe population, there is a great need to store the knowledge that the community already has. This knowledge is related to biodiversity

i.e seeds, trees, vegetables, seed conservation and preservation, cultural values related to warli art, bamboo craft, tarpa music and dance etc.

Network architecture of Pathardi

1. The overall network architecture of Pathardi has been decided to be divided into online and offline connectivity. Please refer to Fig. 1 below. In the current APC project, only Pathardi and Ramkhind hamlets / clusters were connected. Dongarpada as the third cluster/hamlet is used only for representation purposes.
2. Pathardi hamlet was decided to be the central point of the entire network. Refer to Fig. 1 below. Pathardi is the only hamlet where the online connectivity has been enabled. In the rest of the other hamlets, it is an offline mesh network.
3. It was decided to set up a short heighted tower in each hamlet. Point to point links would be set up and connected to each other in every hamlet.
4. It was decided that online connectivity in Pathardi will be enabled through a SIM card based Cellular Router. Mobile signal strength of Airtel showed 5 Mbps. Thus it was decided to procure an Airtel SIM card.
5. This online connectivity would be made available in the vicinity of the tower in Pathardi by Anjali Wajre to provide banking services to the people in the village, refer to Fig.2 below.
6. The rest of the network would be an offline mesh network. For the mesh, two access points need to be set up in each hamlet. These access points would be connected to the point to point link set up on the tower refer to Fig 3 below.
7. The devices would be operated on solar power as an alternative source of energy.

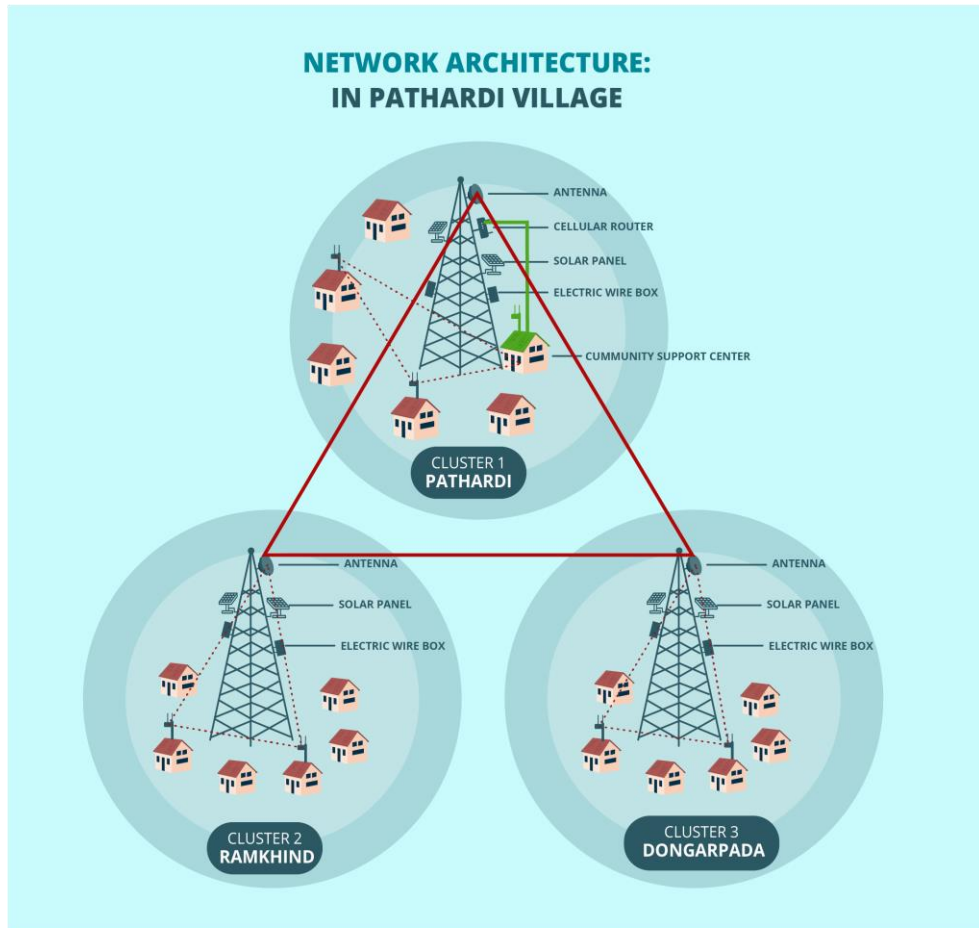


Figure 1: Network architecture in Pathardi depicting both online and offline connectivity

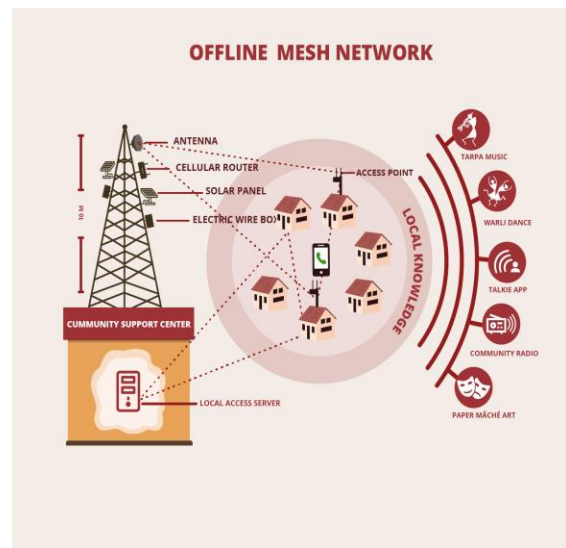
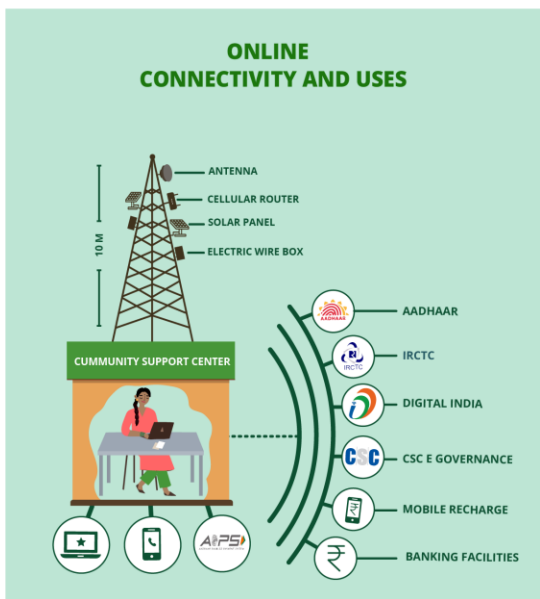


Figure 2: Online connectivity and its uses Figure 3: Offline mesh network and its uses

Day 1: 18 November 2019

We visited Solepada hamlet of Pathardi where M2M Cybernetics had setup a 9 m tower. This was done after site survey the tower set up was done with the active cooperation of the community members in Pathardi.

One of the logic for setting up the tower at Solepada was that there were already towers at Ramkhind and Pathardi and one more tower at Solepada with the devices installed on it could bring them all in the same network. Also, the internet speed at Solepada (Figure 3) is faster (Jio 470 kbps, Vodafone-Idea 550 kbps) than that in Pathardi (Jio 190 kbps) and Ramkhind (Jio ~10 kbps). Hence, in future, if we decide to set up a cellular router at Solepada, it could help in providing better internet connection at Pathardi and Ramkhind as all of them are in the same network.

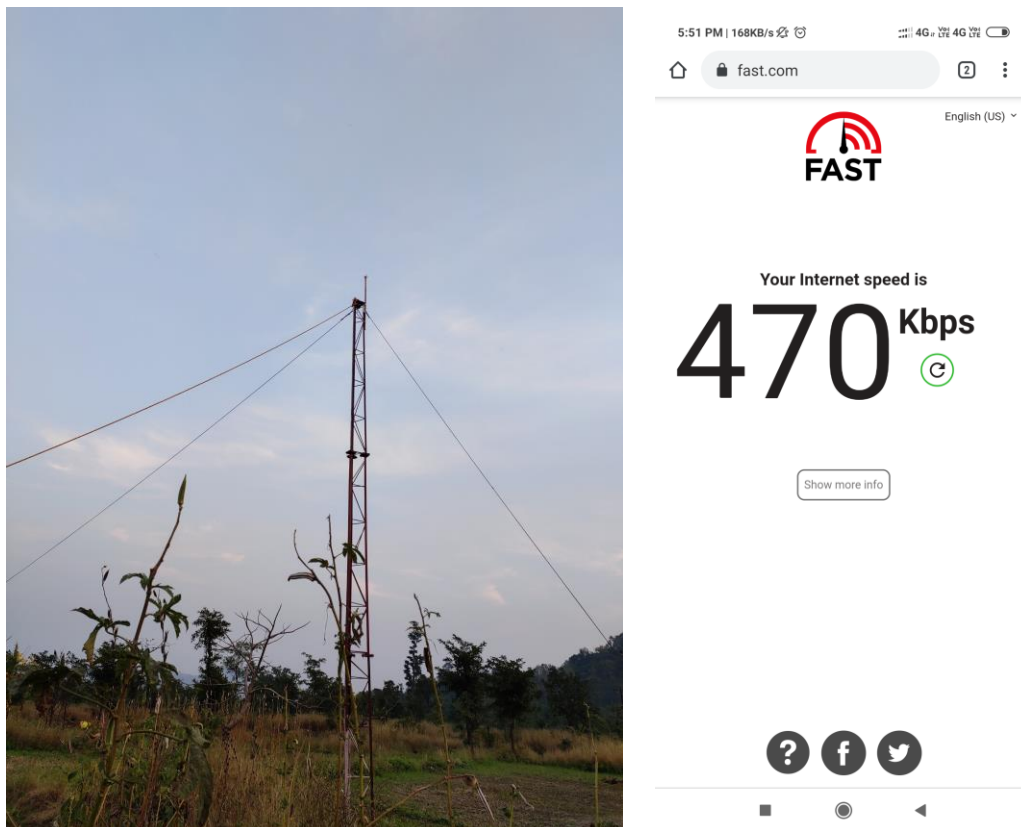


Figure 3: Tower at Solepada and the speedtest of Jio at Solepada showing 470 kbps.

As of now the devices are yet to be installed on the tower at Solepada. The current intranet comprises of Pathardi and Ramkhind hamlets, however, the network can be extended based on the need and availability of devices.

Day 2: 19 November 2019

On the second day, we undertook a visit to Bhatipada and Kukdipada hamlets of Pathardi Gram Panchayat which are together usually referred to as Kukdibhati. Bhatipada is very remote and is approachable from Solepada hamlet by a trek. The other way is to approach it using a two-wheeler from a village called Zhap. We wanted to visit Bhatipada as we were undertaking a project in Pathardi Gram Panchayat and we wanted to plan and do as much as possible for this hamlet too. We started our trek in the morning and reached Bhatipada passing through a deciduous canopy whose terrain was quite undulating (Figure 4).



Figure 4: APC project team members including Dr Sarbani Belur and Anjali Tai undertaking the trek to Bhatipada.

Once we reached Bhatipada after a trek of about two hours we checked the internet speed and it was quite reliable for Jio with 210 kbps and Vodafone-Idea with 5.6 Mbps. The location of Bhatipada is picturesque comprising roughly 25 households with hills all around and a stream

flowing alongside for most parts of the year (Figure 5). This place seemed quite suitable for rural tourism.

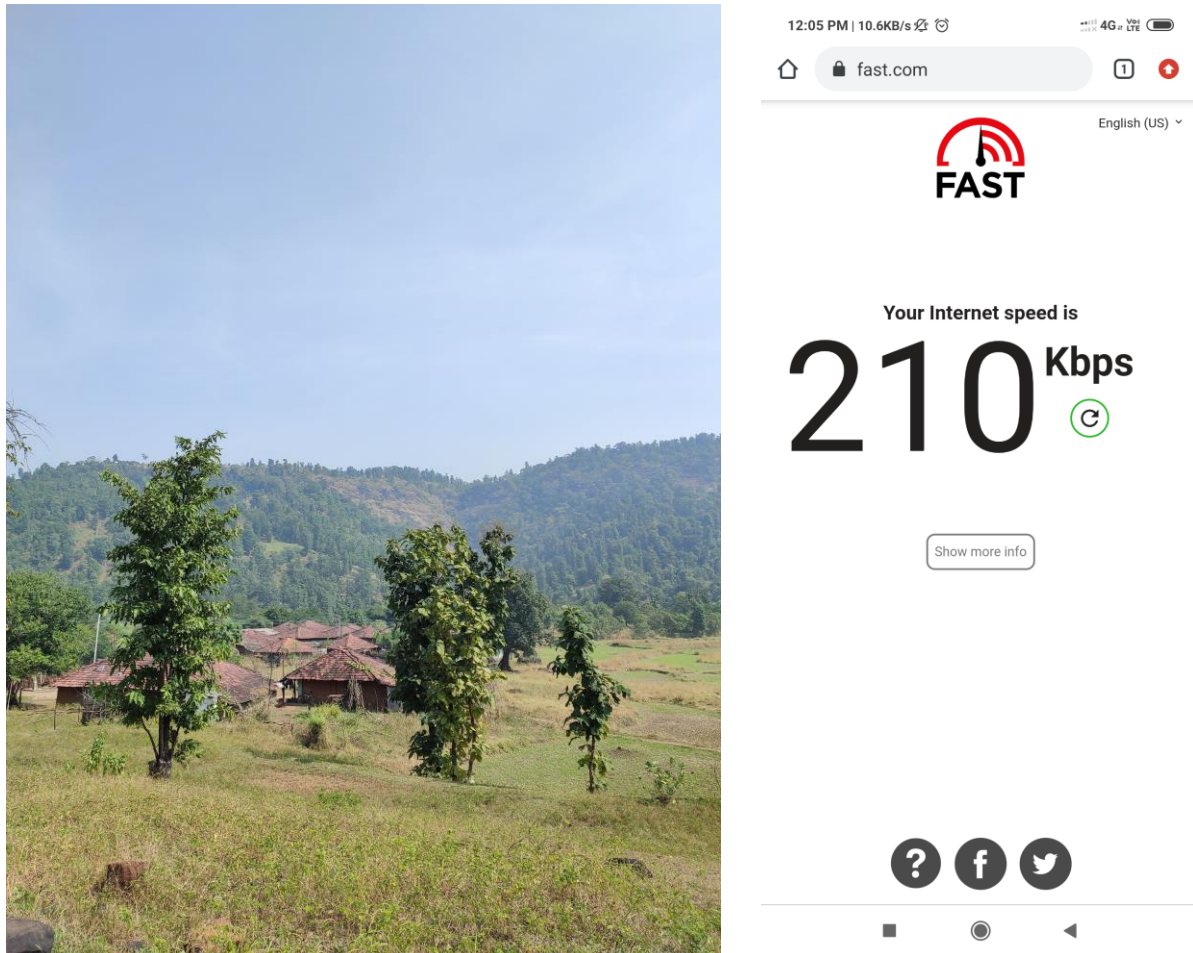


Figure 5: The picturesque location of Bhatipada and the internet speed of Jio (210 kbps) at Bhatipada

In Bhatipada some of our colleagues joined from the Zhap route. Some of us further went to visit Kukdipada which has only 3 households. We had to cross the stream twice before we could reach Kukdipada. After reaching Kukdipada we undertook discussions with a farmer at Kukdipada (Figure 6). We also visited the mini waterfall at Kukdipada and witnessed the traditional way of fishing at the stream (Figure 7).



Figure 6: Crossing the stream to reach Kukdipada and discussion with a farmer at Kukdipada.



Figure 7: Mini waterfall and fishing at the stream near Kukdipada.

After this we came back to Bhatipada to have lunch locally prepared by the women's group (Figure 8). Post lunch we also undertook a demonstration of Aadhaar enabled Payment System (AePS) offered by eDost Anjali Tai (Figure 9). We requested the community members at Bhatipada to nominate their own eDost, so that they can have easier access to digital financial services. After the demonstration we trekked back on a different route towards Zhap (Figures 10, 11 and 12).



Figure 8: Team members savouring lunch at Bhatipada.



Figure 9: Demonstration of AePS services offered by eDost at Bhatipada.



Figure 10: Crossing the stream to trek back from Bhatipada towards Zhap.



Figure 11: View of Bhatipada during the trek towards Zhap.



Figure 12: During the trek towards Zhap.

Day 3: 20 November 2019

On the third day, the formal online network deployment was taken up. Mr Gaurav from M2M Cybernetics had reached Pathardi several days before the actual deployment. All the devices were set up on the tower in Pathardi hamlet (Figure 13). The devices that were installed are SIM card based cellular router, point to point (P2P) dish antenna, access point, solar panels and battery box. This was undertaken on the tower close to Anganwadi (government sponsored play home for children aged less than 5). Hence, a rack was installed on the wall inside the Anganwadi in which would house the local access server. This rack has been placed under lock and key.

Another access point was also installed in Pathardi hamlet which was wirelessly connected to the access point installed on the main tower near the Anganwadi of Pathardi (Figure 13).



Figure 13: Installations on the main tower near Anganwadi in Pathardi hamlet. Deployment of another access point in Pathardi hamlet.

Towards the evening the deployment of point to point (P2P) dish antenna, access point, solar panels and battery box were being undertaken at Ramkhind hamlet (Figure 14). The two P2P dish antennas (one at Pathardi and one at Ramkhind) would communicate to create a common network. The installations were done in close cooperation with the community resources persons namely Mr Akash and Mr Ganesh. Through this, a hands-on training of network deployment and maintenance was given by Mr Gaurav of M2M Cybernetics to the CRPs in Pathardi.



Figure 14: Deployment on the tower at Ramkhind.

Day 4: 21 November 2019

On the fourth day, we focused on the offline network deployment. For this, Mr Sanket and Ms Shalini representing Servalots, Bengaluru had come to Pathardi. They had brought along with them the Raspberry Pi devices, power banks, Pi cases, SD card etc. The Pis were configured and set up for deployment. Each of the Pi boxes were given to the CRPs nominated by BAIF. It was also conveyed to them how to use the Pis and how to access information on the smartphone (Figures 15). So the architecture of the offline network was such that each of the hamlets would be connected in an offline mesh network. The point to point links would help in making the mesh network into a larger mesh network. Different applications that were enabled in the offline mesh network were Talkie application, community radio. Talkie is an offline talking application which can connect people in an offline mesh network to talk and share information with each other. The Raspberry Pi based community radio was also another application that would be used for local knowledge creation and sharing. Each of the access points in the hamlets would be the points from where the offline videos, audios etc can be shared. A local repository of the offline

information would be stored in the local access server. Adequate training was given by Servalots to the CRPs and field coordinators in Pathardi to use Raspberry Pis as offline hotspots and community radio and were also handed over to them for use respectively.



Figure 15: Training on the use of Raspberry Pi underway.



Figure 16: Mr Akash, a community resource person (CRP) trying out the Raspberry Pi based community radio.



Figure 17: Servelots team handing over the Raspberry Pi based community radio to the APC Pathardi team.