



# Need And Scope of TeleHealth in Remote Hilly Areas

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# Contents

<b>Acknowledgement</b>	<b>3</b>
<b>Summary</b>	<b>3</b>
<b>1 Motivation</b>	<b>6</b>
<b>2 Introduction</b>	<b>8</b>
<b>3 Literature Review</b>	<b>11</b>
<b>4 Survey</b>	<b>13</b>
4.1 Survey Methodology . . . . .	13
4.1.1 Population of Interest . . . . .	13
4.1.2 Sampling Method . . . . .	14
4.1.3 Research Process and Questionnaire . . . . .	14
4.2 Noticeable Interviews . . . . .	15
4.2.1 Interview with the CMO of Lahaul & Spiti . . . . .	15
4.2.2 Interview with a student of IIT Mandi who lived in Lahaul & Spiti . . . . .	17
4.2.3 Interview with a representative resident of Lahaul District . . . . .	17
4.2.4 Interview with a representative doctor from Udaipur .	18
4.3 Inferences from our Interviews . . . . .	19
<b>5 Methodology</b>	<b>20</b>
5.1 Cell Tower Plan . . . . .	21

5.2	WeCare . . . . .	25
5.2.1	About the App . . . . .	26
5.2.2	App Usage . . . . .	26
<b>6</b>	<b>Conclusions</b>	<b>30</b>

## List of Figures

1	Flow Chart illustrating the Healthcare Challenges with proposed solutions. . . . .	20
2	Location of Villages in Lahaul & Spiti pointed on Google Maps. .	21
3	Proposed Location of Towers in Lahaul & Spiti pointed on Google Maps. . . . .	22
4	Home Page . . . . .	27
5	Joining page for doctors . . . . .	28
6	Joining page for patients . . . . .	28
7	Demo conversation between a patient and a physician . . . . .	29
8	Demo conversation between a patient and a physician . . . . .	29

## List of Tables

1	Tower Coordinates . . . . .	24
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## Summary

This COVID-19 has taught us a crucial point that “*Health is wealth*”. For a nation to develop, its people should be healthy to work at their highest efficiency. We do not want the people of India to suffer because of the lack of medical facilities in their area. Hence, we aim to propose a solution so that people from remote areas can avail good medical facilities.

In this practicum course, we realized healthcare problems in remote areas of Himachal Pradesh, specifically, Lahaul and Spiti. We used a non-random sampling method, snowball, to be precise and collected valuable insights from the residents and doctors. We pinned down four significant problems: no availability of specialist doctors, dealing with emergencies is difficult, the introverted nature of residents, and network coverage issues.

For improving network coverage, we made use of the K-Means algorithm. We estimated the coordinates of towers to reduce the expenses for the unwanted towers and make sure that the towers are sufficient to solve the network issues. K-means is a clustering algorithm that groups the coordinates in K number of centroids and allocates every data point to the nearest cluster. We also proposed an app, “WeCare” which will bridge the communication gap between patients and doctors for the other three problems. “WeCare” also acts as an emergency handling app that would alert the authorities to handle these situations with speed and accuracy.

## Abstract

With the increase in different types of diseases, people are becoming more cautious about their health and the healthcare facilities. As engineers, it's our responsibility to find an efficient solution to provide good healthcare facilities to people living in remote areas of Himachal Pradesh. For providing healthcare facilities in remote areas, we aim to use TeleHealth solutions. In this project, we study the need and scope of TeleHealth in remote areas. We survey the current availability of healthcare facilities by contacting officials and residents of Lahaul & Spiti. We identify the primary health care problems and propose an online app **WeCare**. We aim to improve the current healthcare facility by connecting people with specialist doctors across India using WeCare. Further, we develop a new cell tower plan to provide a high bandwidth network coverage across the Lahaul and Spiti districts.

## 1 Motivation

The concept of TeleHealth is old [1] but it came to practise recently with the advent of internet. TeleHealth is the use of information and communication technologies like mobile phones and the internet to access health care services remotely and provide a necessary remedy for any illness. TeleHealth currently exists in some of the big cities of India like Mumbai, Bengaluru, Delhi, etc which is currently out of reach of the common people belonging to small cities and towns.

It is known that there is one allopathic doctor for every 4639 persons in Himachal Pradesh while WHO recommends one doctor for every 1000 persons

[2]. In some areas like Lahaul & Spiti, conditions get worse depending upon the facilities they have. In view of the fact that India is a developing country with urbanization at its peak most qualified doctors choose to pursue their careers in metropolitan cities so rural areas like that of Lahaul & Spiti lack the presence of well-qualified doctors. The number of specialized doctors (like neurosurgeons [3]) in India is very limited so there is a need to make them available to every needy person of the country and Himachal being a remote area these numbers are very less in comparison to other states. The majority of the population in Himachal Pradesh stay in rural areas and some places are even inaccessible in winter owing to several reasons like Landslides, Snowfall, and Rainfall [4]. In winters medical facilities are much more needed compared to summers and the unreachability factor makes it even more difficult to provide healthcare facilities in winters so ‘TeleHealth’ seems to be a choice for consultation with doctors.

Because of the above-stated reasons and Himachal being our current home becomes the automatic choice for the implementation of our idea of Tele-Health. People of Himachal neither have the facilities nor the time to afford the travel to places like Chandigarh and Delhi. This would establish an instant connection between patient and physician overcloud.

Our vision of TeleHealth for these areas tries to solve this issue to some extent by providing assistance from some of the best doctors to concerned people, it will increase the accessibility of doctors in hilly areas. Since India lacks good healthcare facilities [5, 6] this will provide efficient use of these facilities and so we aim to help the people of Himachal Pradesh by providing every available medical facility to them.

In the Section 2, we introduce TeleHealth and discuss its benefits and challenges. In Section 3, we provide a literature review related to TeleHealth. In Section 4, we provide details about our interviews with the people of Lahaul & Spiti. In Section 5, we detail our methodology and then in Section 6 we conclude our report.

## 2 Introduction

Our objective is to analyze the need and scope of TeleHealth facilities in the remote areas of India. Since we have limited infrastructure for medical systems in remote areas, we aim to bring medical facilities for the people living there using TeleHealth.

TeleHealth is about the use of digital communication technologies, like mobile phones, computers to provide medical care facilities to people living in remote areas. One can have sessions with well-trained physicians and evaluate their current health condition without actually going to hospitals. This is extremely beneficial for the people who live in remote hilly areas or the areas where transportation is a major concern. There are many such places in Himachal that are not motorable so we believe developing TeleHealth facilities would be advantageous in such places.

One can communicate with a doctor more frequently, analyze the current situation and make necessary changes to their ongoing treatment. In case of any medical tests taken, you always have an option to get it reviewed by a senior doctor, which saves a lot of time as this doesn't require an in-person visit most of the time.

## **Types of Telemedicine solutions:**

1. **Store-and-Forward Telemedicine:** In this method, patients provide (upload) their medical reports like MRI Scans, Blood test reports, etc on a specific platform. These reports are then anonymized and forwarded to one or more specialists. This method provides convenience to doctors as they can check the reports when they have time and provide feedback.
2. **Remote Patient Monitoring:** In this method, doctors constantly monitor the patient's vitals remotely. This type of solution is beneficial in the treatment of chronic conditions or when a patient is recently discharged from the hospital.
3. **Real-time telemedicine:** This is like a real-time video call with a doctor. This is beneficial when patients need to discuss his/her health conditions or when a doctor wants to interact with a patient (eg. in mental health-related problems)

During the ongoing COVID crisis, the flaws in our medical system were prominently brought out. As there was less availability of beds, the number of patients was increasing exponentially at their peak point, and the physician-to-patient ratio was also less. Noting these facts TeleHealth looks like a better option using which treatment can be done while being at home. TeleHealth looks impressive but it also comes with some challenges:

1. **Privacy:** There is an involvement of technology providers, hence consent may be needed to keep the information private.

2. **Safety:** Health information may be compromised through transmission.
3. **Medical Licensing:** Physicians need a medical license in every community they provide TeleHealth services.
4. **Diagnosis:** It is also difficult to take scans that require access to machines like X-Ray, MRI Scanner
5. **Inefficiency:** 30 minutes for virtual consultation whereas only 15 minutes for an in-person consultation.
6. Cost of telecommunication, data management equipment, and technical training of physicians.
7. Decreased human interaction between physicians and patients.
8. Immediate treatment is not possible.
9. Regional internet availability.

With the advancement in Artificial Intelligence and Robotics, health care robots, teleoperated robots can improve the health care facilities available in remote areas. Various agencies like Harmony<sup>1</sup>, Moxi<sup>2</sup> are investing a lot in health assistive robots so we believe our work will be beneficial to such agencies as well.

In this project, we found out that network connectivity is not good in many parts of Lahaul and Spiti. Hence we worked on the algorithm to

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<sup>1</sup><https://harmony-eu.org/>

<sup>2</sup><https://diligentrobots.com/moxi>

implement distribution of towers to provide good network connectivity to inhabited areas.

Then we proposed a lightweight application so that it could be used in areas with poor connectivity where doctors from various hospitals will be present and patients can connect to doctor they want to at any point of time.

### 3 Literature Review

*Ganapathy et al.* [7, 8] discusses about the unavailability of quality of health-care in remote areas of Himachal Pradesh. A remote virtual healthcare project was initiated at Keylong and Kaza named PPP(Public-Private Partnership). This PPP provides affordable healthcare to this remotely situated community where these people have to travel 100s of kilometers for secondary healthcare facilities. Following this, an MoU was signed by Apollo hospitals in January 2015 with a national health mission, which was paid for by the government. Later the staff recruited from the community and the local government staff were trained in Chennai. The cases were recorded and it was found that, in the first 42 weeks, a total of 2,213 teleconsults were made, including 171 emergencies. Later Telelaboratory and TeleHealth education programs were also added. The evaluations confirmed the success of the PPP model in remote inhospitable terrains of Himachal Pradesh.

As discussed in [9, 10, 11], Indian Space Research Organization (ISRO) has been setting up SATCOM-based TeleHealth facilities across India since 1999. Various government agencies have also joined hands for providing

quality healthcare facilities to rural and remote areas across the country. For supporting telemedicine across India, the Department of Information Technology has declared the standards for TeleHealth systems, and also a national telemedicine task force is also formed by the Ministry of Health & family welfare. Telemedicine can be a great revolution in the medical world. we can use a large number of satellites, phone communication, and government resources and its coordination, it is possible to reach every person of India for achieving the goal of Health for all.

Himachal Pradesh has a population of more than 6 million people living in an area of approx 55,500 sq. kms. For telehealth tasks to be effective, capital costs should be limited. This requires utilizing ease gear, and yet of adequate particularity to communicate pictures of satisfactory quality for diagnostic purposes. According to [12], physicians are more driven by humanitarian benefits rather than monetary benefits. The authors have established the hybrid Telemedicine model (store and forward and real-time consultations) in Himachal Pradesh.

*Kumar et al.* [13] discusses about the use of TeleHealth in India. The Internet is expanding rapidly because of which everyone is very curious about the symptoms, check-ups, medicine, and diseases. As a result of which doctors putting content online needs to be more conscious or correct. Telemedicine can provide two-way real-time communication between doctors and patients using audio or video chats. With the knowledge that even in most of the remote parts of our country the Internet is very easily accessible, the result of which we are already using TeleHealth. Querying about our health on phone calls is also TeleHealth. Advancement in technology will

always favor TeleHealth facilities improvement.

In [14], a study was conducted to check if the simple phone-based telemedicine system can improve the follow-up after ambulance surgery. This involved sending images of surgical wounds to assess local complications and avoid any unnecessary hospital visits. The total number of patients enrolled in this study was 96 and the phone used was Nokia 6600. The images were sent using email and viewed on a personal computer. Thirty patients of them reported local problems and a total of 225 photographs were shared by them. It was found that it was possible to identify and assess the problem with agreement among them. Out of the 30 only 1 patient had to visit the hospital in person. This telemedicine system increased the efficiency of home follow-up to ambulatory surgery which in-turn improved patient satisfaction.

## 4 Survey

### 4.1 Survey Methodology

We had limited resources available at stake with us due to the COVID-19 pandemic situation. We had to choose carefully the time and money we could use in this process. As we could not travel to these places we decided to conduct telephonic interviews as this was the most convenient way to conduct surveys for the locals of Lahaul and Spiti.

#### 4.1.1 Population of Interest

The population of interest in this case study was the locals of Lahaul and Spiti, alongwith the doctors in the region. We could not sample the entire

population as it was difficult to conduct interviews with all people due to the sheer size of population keeping in mind the timeframe of the project and the resources available with us. Also, the shy nature of the remote, tribal people posed a big challenge before us.

#### **4.1.2 Sampling Method**

We had no other option than to use the non-probability sampling method as we were conducting telephonic interviews and we could not reach those people who did not have phones.

Snowball sampling was used as a sub method of non-probability sampling method. We had leveraged our contacts in Mandi and Kullu from whom we got contact numbers of some locals in Lahaul and Spiti. We conducted their interviews after which they encouraged other locals to take part in our study, which helped us increase our sample size.

This was the best method as the population there is small and difficult to reach out to due to their shy and not open nature.

#### **4.1.3 Research Process and Questionnaire**

We identified certain key aspects about which we needed to collect the data about. We had to ask certain questions about what is the problem in the current healthcare facilities, what emergency services are available and how are emergency situations handled etc. After which we could do a proper analysis and prepare our proposed solution. We designed our survey to get information about the following points:

1. The existing number of hospitals, ambulances, and health centers at

Lahaul and Spiti.

2. Patient to Physician Ratio in each sub-division.
3. Current approaches/ Solutions used to reach remote and non-mobile places situated in hilly areas.
4. How emergencies and critical medical situations are handled?
5. Do they use any TeleHealth facilities currently?
6. Do they have specialist doctors at their hospitals along with required medical machinery and testing facilities?
7. What are the Internet Speed, Bandwidth, and coverage available to the residents of Lahaul & Spiti?

We contacted officials and the residents of Lahaul & Spiti via telephone. Next, we provide details about our conversation with the respective individuals.

## 4.2 Noticeable Interviews

### 4.2.1 Interview with the CMO of Lahaul & Spiti

We contacted Dr. Paljor (Chief Medical Officer of Lahaul & Spiti) to know about various aspects of health facilities available at Lahaul & Spiti District. At Lahaul-Spiti<sup>3</sup> they have

1. 1 District Hospital

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<sup>3</sup><https://hplahaulspiti.nic.in>

2. 3 Community Health Centers (Kaza, Shansha, Udaipur)
3. 15 Health Centers located at various locations (Lossar, Hansa, Kibber, Sissu, Gondhla, Gemur, Tholang, Jhalma, Thirot, Darcha, Phura, Tindi, Tingret, Tabo, Sagnam)
4. 5 Civil Dispensaries (Darcha, Phura, Kibber, Lossar, Hansa)
5. 36 Small Sub Centers (10 in Spiti, 26 in Lahaul)

along with the above facilities they have access to Ayurvedic medicine facilities including 1 Ayurvedic Hospital and 21 Ayurvedic Dispensaries.

We also got to know the District Hospital has an MoU with Apollo Hospitals, Chennai for TeleHealth facilities. They use this for further consultation with expert doctors to get help regarding prescribing and diagnosing diseases from medical tests and reports. According to Dr. Paljor, the national ambulance service is very efficient, ambulances can reach remote areas easily but still, we need to get ground-level information about the remote non-mobile areas. We will potentially visit these areas and get feedback from the residents of Lahaul & Spiti to verify this. To address emergencies they do first aid in the hospitals at Lahaul and Spiti itself, after the first-aid patients are shifted to hospitals at Keylong, Kangra, or Shimla depending on the severity of the situation.

As far as the Internet is concerned the hospitals have access to good quality internet and district coverage is provided by Jio but still, we will confirm the coverage of facilities all over the district. Before Jio they used BSNL internet and telephone facilities. According to Dr. Paljor currently, they don't have Instruments like MRI Scanner, CT Scanner and for this

patients need to travel to other hospitals. More importantly, they also don't have specialist doctors that can treat severe cases and critical situations.

#### **4.2.2 Interview with a student of IIT Mandi who lived in Lahaul & Spiti**

We had contacted him as he had recently visited the area so that we could get the latest information from him. He told us about his personal experience. Being a resident of Kullu he had faced the problem of lack of specialist doctors when diagnosed with pneumonia and according to him the situation in Lahaul and Spiti is even worse. In Lahaul, there is no big hospital, there are only small clinics and dispensaries. The residents there have to mostly go to Kullu or Manali for treatment. Sissu village, despite being the biggest village, has no big hospital or health centers. He also told us that roads are not quite connected to remote areas and in winter only helicopters can reach these places with heavy snowfall, the whole area gets cut off due to road blockage. He also told us about the substandard internet services there. The service is only good for calls and there are heavy fluctuation and voice breaking. BSNL works decently and Jio has very poor speed. Although 3G is there still the level of speed is nowhere near to even other remote places in India.

#### **4.2.3 Interview with a representative resident of Lahaul District**

We interviewed the person<sup>4</sup> and got to know more about the remote places in the district. He told us that in winters there is snow up to knee-length

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<sup>4</sup>Identity is kept confidential on his request.

and even to go nearest of places the snow needs to be cleared. Govt facilities are very slow for cleaning of snow and only clean the main roads. Also, there are no proper facilities for performing immediate surgery in case of a critical injury, only first aid is available at the nearby health center. The nearest health center is also around an hour away. Not all necessary medicines available at the nearest health centers. For chronic diseases, they need to go to Keylong, and if not treatable there then to Kullu or Shimla. He also said that many people want to go to better places like Kullu or Mandi and settle there if given a chance.

#### **4.2.4 Interview with a representative doctor from Udaipur**

We interviewed Dr. Rahul Thakur, whom we had learned about from Mr. Aki Bodh, a resident of Udaipur. Dr.Rahul told us about the lack of specialist doctors in the region. Even the hospital where he worked, i.e., the Keylong RH District hospital, had very few specialists. Even there was no pediatrician for kids, no gynecologists. There was no facility of blood banks in the district for dealing with emergencies. In most emergency cases, the doctors could only stabilize the patient and send them to Shimla or Kullu for further treatment. He also acknowledged the lack of adequate facilities during COVID-19. The patients were sent to the Kullu for isolation and treatment until they were infected. Transportation using ambulances was also not possible in many areas, and many times they had to use helicopters to transport patients. Thus, we learned about the situation from a doctor working in one of the leading hospitals in the Lahaul and Spiti District.

### **4.3 Inferences from our Interviews**

We identified some key problems like Internet coverage was substandard, poor accessibility to remote villages, emergency protocol was not administered properly, harsh winter conditions, district subdivision not having any secondary or tertiary health centres. Now explaining each problem in depth. 4G internet was available at some major tourist places like Sissu and Keylong but not at other remote locations. Many villages are not directly connected to roads and ambulances can not reach them properly. Many locals described their painful experiences of dealing with emergency situations and had to wait for a long time or had to travel to another district like Kullu or Shimla to get treatment. In winters many places have snow till knee height and the only way to reach them is through helicopters which are difficult to operate in harsh weather conditions. Also many places have only Primary health centres with limited medicines available there.

## 5 Methodology

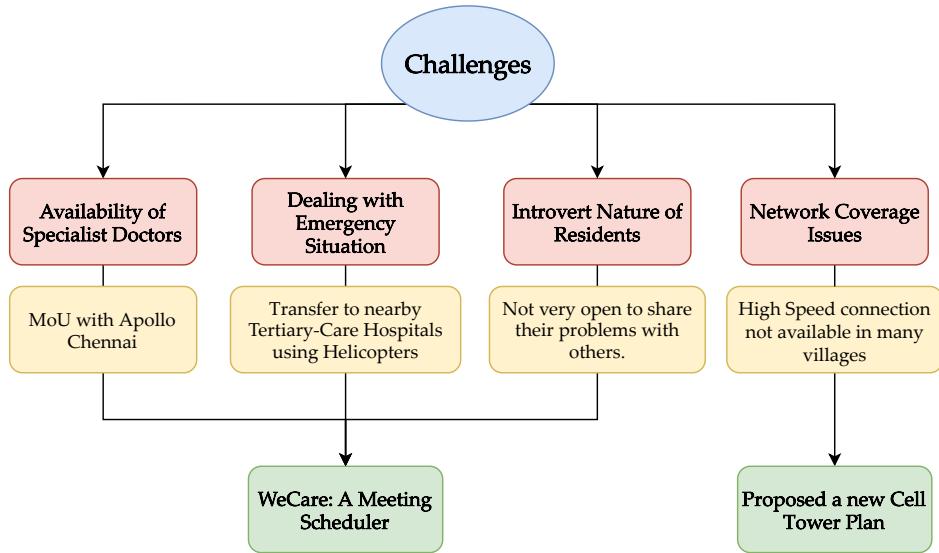


Figure 1: Flow Chart illustrating the healthcare challenges along with our proposed solutions. The red color boxes indicate the problems; yellow color boxes indicate the current situation, and green color boxes indicate the proposed solutions.

In this section, we describe our research methodology to counter the problems detailed in section 4.3. We develop a new cell tower setup plan (Sect. 5.1) across the Lahaul and Spiti district for improving the internet connectivity and an online application WeCare (Sect. 5.2) to provide better TeleHealth services.

## 5.1 Cell Tower Plan

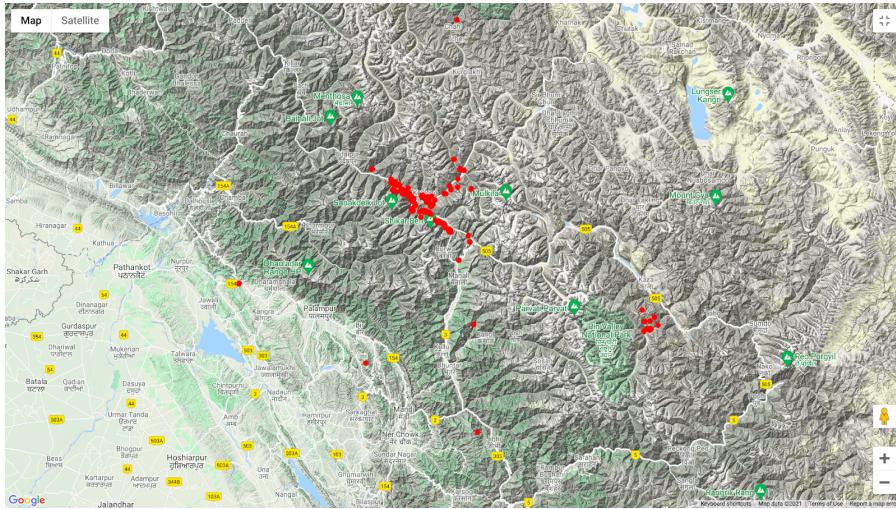


Figure 2: Location of Villages in Lahaul & Spiti pointed on Google Maps.

One of the basic requirements of TeleHealth is good network bandwidth and in our survey, we found out that some places in Lahaul & Spiti have good bandwidth (4G) and there are some places where there is not enough bandwidth. We further analyzed the online available network coverage data<sup>5</sup> to lay out a new plan for installing cell towers across the district. We aim to provide good internet connectivity to most residents with our cell tower distribution plan.

We use the data collected during Census 2011 for obtaining the location and population of all 120 villages in Lahaul & Spiti district. We find that more than 50% of the geographical area of the Lahaul & Spiti region is uninhabited. Below we provide some facts and assumptions.

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<sup>5</sup><https://www.nperf.com/en/map/IN>

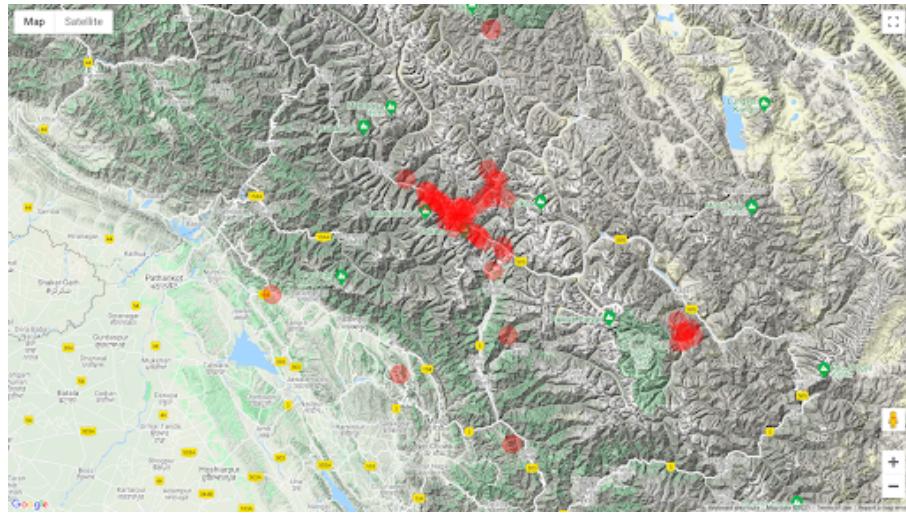


Figure 3: Proposed Location of Towers in Lahaul & Spiti pointed on Google Maps.

**Facts:**

1. Range of sight of any tower is given by  $R = \sqrt{2 \times H \times R_e}$
2. The height of the tower can not be more than 30 meters in hilly areas.
3. In remote hilly areas, the range can not be more than 5-8 km, and for subterranean usually, it is 2-3 km.
4. We take into account the reflections of the signal from mountains.
5. The range of tower depends upon the frequency of the signal in use and the transmitter's rated power.
6. It may also be limited by local geographical or regulatory factors and weather conditions.

**Assumptions:**

1. The height of the tower will be around 25-30 meters.

2. The range of each tower is assumed to be equal to 3.5 Kms of radius to avoid significant reflection from mountains.
3. Absorption of radio energy by hills is not considered.
4. Provided the network services only to the areas which are inhabited.

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**Algorithm 1:** K-Means Algorithm

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**Input:** A set of coordinates  $P = \{p_1, \dots, p_n\}$ , a number of cluster  $k$

**Output:** Coordinate  $\{c_1, \dots, c_k\}$  dividing  $P$  into  $k$  clusters

Randomly initialize  $k$  centres  $C = \{c_1, \dots, c_k\}$

**while** stopping criterion has not been met **do**

**for**  $i = 1, \dots, N$  **do**

| find the closed centre  $c_k \in C$  to instance  $p_i$

| assign instance  $p_i$  to set  $C_k$

**end**

**end**

**for**  $i = 1, \dots, k$  **do**

| set  $c_i$  to be the center of mass of all the points in  $C_i$

**end**

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<b>Sr. No.</b>	<b>Latitude</b>	<b>Longitude</b>
1	32.60476	77.14968
2	32.03405	78.06006
3	31.90818	76.75387
4	32.53536	76.98558
5	31.63098	77.27903
6	32.22460	76.15650
7	32.41437	77.23491
8	31.23089	76.98100
9	33.26619	77.18289
10	32.59189	76.88395
11	32.47087	77.09069
12	32.06174	77.26036
13	32.56253	77.04692
14	32.58017	76.93761
15	32.67698	77.19687
16	32.43336	77.14718
17	32.48802	77.01142
18	32.53628	77.06007
19	32.67800	76.78270
20	32.31735	77.19053
21	32.60024	77.24925
22	32.05916	78.12733
23	32.11863	78.05311
24	32.55515	76.97289
25	32.62917	76.88945

<b>Sr. No.</b>	<b>Latitude</b>	<b>Longitude</b>
26	32.58099	77.12556
27	32.50479	77.05114
28	32.44876	77.12549
29	32.60700	77.18505
30	32.04275	78.08689
31	32.07480	78.08984
32	32.59326	76.92302
33	32.57084	77.01856
34	32.71700	77.16715
35	32.51096	77.02889
36	32.57302	76.96047
37	32.61364	76.90214
38	32.59337	76.94642
39	32.57020	77.06238
40	32.63980	77.18571
41	32.46131	77.11896
42	32.09121	78.11058
43	32.38985	77.24232
44	32.07356	78.06354
45	32.51519	76.97123
46	32.63052	76.87144
47	32.55776	77.03435
48	32.51068	77.01022
49	32.67378	77.21590
50	32.55584	77.07742

Table 1: Tower Coordinates

After considering the above assumptions, we plot the coordinates of all the villages as shown in Figure 2. We group these coordinates using the K-Means [15] clustering algorithm 1, which generates  $K$  coordinates that best covers all the areas. We found that approximately 50 towers are required in Lahaul & Spiti for good bandwidth (4G connectivity). We provide the location of potential tower coordinates in table 1 along with a map (Figure 3) showing the network coverage. After inspecting the site, various cell companies can consider setting up the towers.

## 5.2 WeCare

From the survey conducted, we found a lack of specialist doctors in remote areas of Himachal Pradesh, due to which people at the time of health issues need to go to distant places for their treatment. Also, we found that Lahaul Spiti has signed a MoU for telehealth facilities with Apollo Chennai, where specialists choose a day in a week and plan their meetings with patients from these areas accordingly.

The problem comes when there is an emergency situation and the doctor is not available. Here, our app “WeCare” helps out, where we intend to connect with more hospitals which implies more doctors, thus solving our problem. There is no time frame to meet specific specialists. One can connect to doctors at any time and can access health services remotely. The source code of our app can be found at <https://github.com/Smrt-Sanskar/ISTP>.

### 5.2.1 About the App

WeCare is a lightweight and easy-to-use application<sup>6</sup> interface where one can connect directly with doctors and talk about their health issues in the chat. It is a unique option for handling emergencies. With this app, we aim to tackle three problems:

**Lack of Specialist doctors:** WeCare allows thousands of doctors to join the healthy WeCare community to help the people. With more specialist doctors, people living in remote areas will be able to avail good health services.

**Difficulty with dealing with the emergency:** We provide unique functionality to deal with emergencies in which nearby people get to know about the issue to help improve the situation. We believe everyone will understand others' pain and will come to help. Furthermore, after interviewing a resident of Lahaul-Spiti, we also learned that community bonding is powerful in these areas, so we are optimistic that people will help each other.

**The unwillingness of residents to get treatment:** From our survey, we learned that many people were unwilling to talk to someone not belonging to their region. Considering the people's introverted nature, we developed a text-based app that does not require face-to-face interaction.

### 5.2.2 App Usage

**For doctors:** When a doctor enters the WeCare using the "Join as a Doctor" option, a room corresponding to his specialization and name gets created. It becomes visible to all the patients there in the "Join as a patient" lobby.

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<sup>6</sup><https://we-care-1s.herokuapp.com/>, Last Accessed 10 June, 2021

**For patients:** When a patient enters WeCare using the “Join as a patient” option, a list of all currently available doctors appears along with their specialization. Now the patient can choose the doctor and join their chat room. A patient can choose any room matching his/her health problem and establish a direct connection with the doctor.

**In case of an Emergency:** Whenever a district official declares a medical case as an emergency, app users within 5 km range get the notification about the emergency to do the needful action. Using the emergency service required some more inputs like current location, mobile number.

#### **Limitations:**

1. Diagnosis: Scans that require big machines are not possible
2. Lack of human interaction
3. Immediate treatment is not always possible

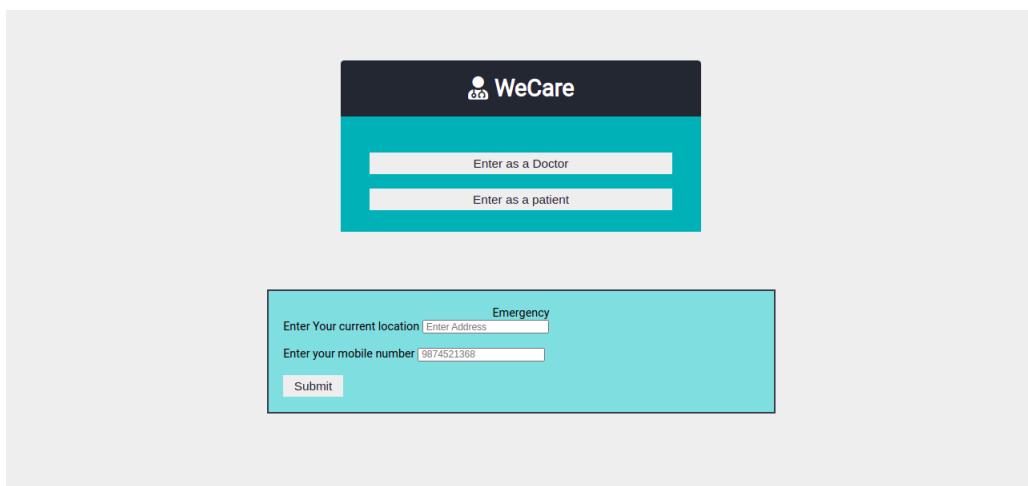


Figure 4: Home Page

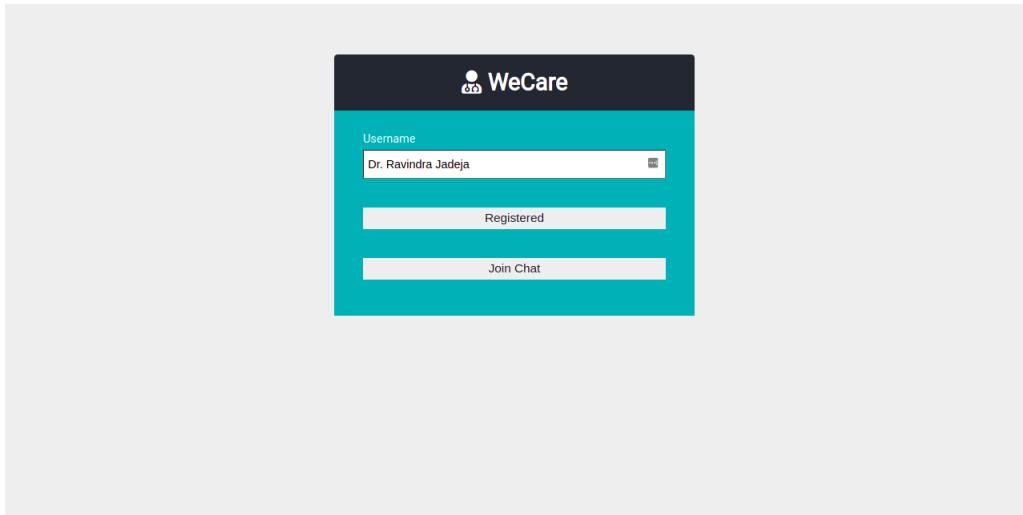


Figure 5: Joining page for doctors



Figure 6: Joining page for patients

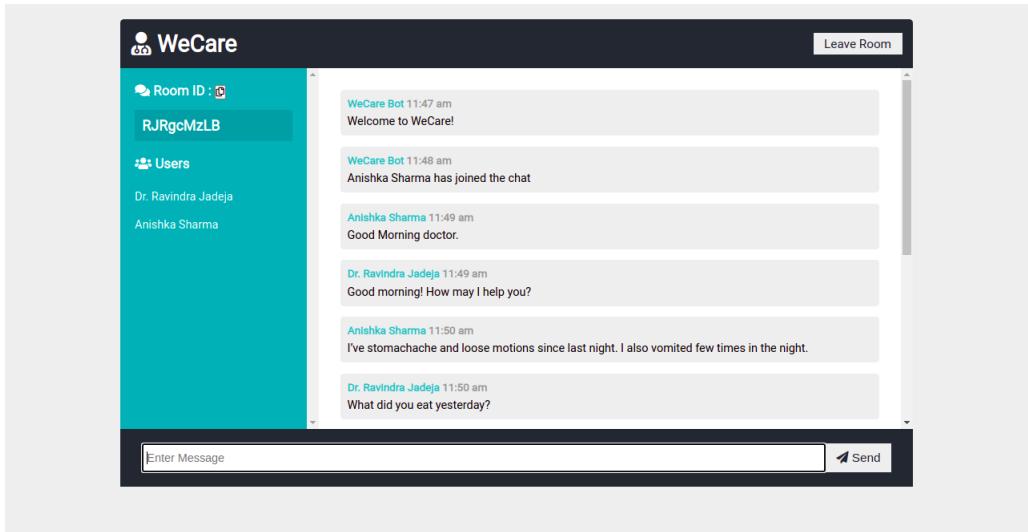


Figure 7: Demo conversation between a patient and a physician

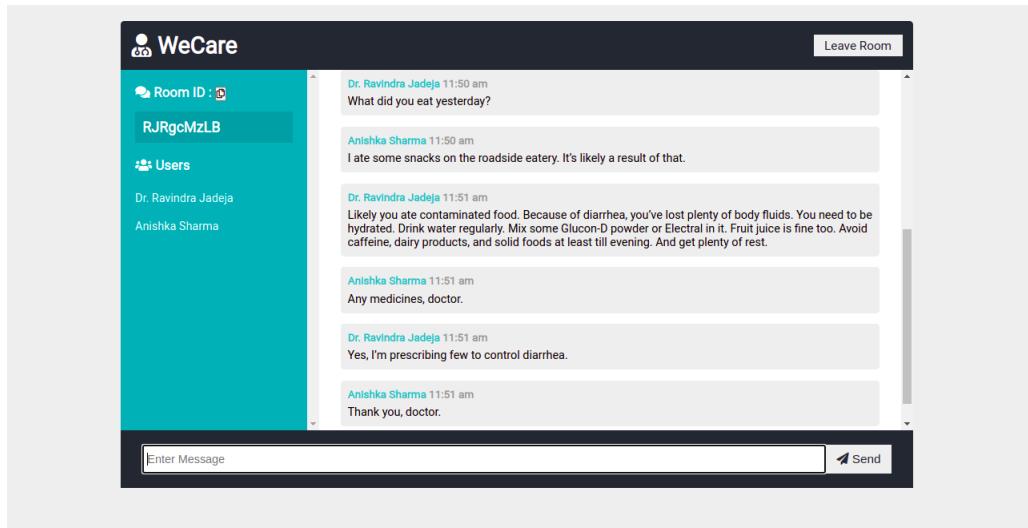


Figure 8: Demo conversation between a patient and a physician

## 6 Conclusions

Health facilities are foremost concerns of every human, so in this project, we study the need for medical facilities in remote areas of Himachal Pradesh. Specifically, we analyze the need for TeleHealth facilities which refer to the use of communication devices to get access to health facilities remotely. For collecting information about the current health conditions in Lahaul & Spiti, we did a telephonic survey in which we got to know that the residents face problems during winters due to the piling of snow and to provide TeleHealth facilities internet availability becomes a major concern but fortunately some of them now have access to 4G internet connection. In this project, we saw how grave the problem of healthcare is in the Lahaul and Spiti district of Himachal Pradesh. Due to limited resources and time constraints available with us during the COVID-19 lockdown, we adopted the snowball sampling method and collected valuable data from the locals and doctors. Further analysis of the data led to us identifying the key problems. We proposed our solution to solve the network coverage problem by our tower proposition algorithm which solves the problem in a unique way by using the existing government data available publicly about the remote places. We also applied our technical and developmental knowledge to combine the problems of shy nature and communication gap between doctors and locals. Thus proposing our app “WeCare” which easily lets patients connect to doctors, which could make proper use of the MoU with Apollo Chennai. “WeCare” also acts as an emergency situation handling app which would alert the authorities to handle these situations with speed and accuracy. In the future, we can further develop our WeCare app by including a Video Call feature, along

with machine learning-based diagnosis options; for instance, we can include ChexNet algorithm used to diagnose chest X-Rays<sup>7</sup>.

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<sup>7</sup><https://stanfordmlgroup.github.io/projects/chexnet/>

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