

PART II: TECHNICAL INFORMATION

1	<p>Aim and Scope of the project: (in terms of specific physical achievement)</p>	<p>The aim of this proposed system is to showcase the potential contributions that IoT & AI technologies can make to enhancing sustainable rural livelihoods. The proposed TribeConnect project aims to provide a unified platform for monitoring and sensing, data gathering, inferring and decision-making for various application domains. The main focus is to transform the current tribal village toward a smart full-grown village. The key enablers for the above are given with the following objectives:</p> <ul style="list-style-type: none"> a) To develop ICT based Rural Health & Social Care <ul style="list-style-type: none"> • Smart Anganwadi Kendras for malnutrition care • Smartphone based Blood Anemia care for Pregnant Mother • Tele-medicine for primary health diagnosis and service b) Develop an IoT-based Smart Harvest & Management System <ul style="list-style-type: none"> • Smart Farming-Disease prevention, irrigation and timely information • Smart Well for water quality monitoring • IoT based disaster monitoring and alerting system c) To develop a software and hardware prototype to enhance Empowerment & Services <ul style="list-style-type: none"> • ICT based network to promote education • e-Mandi platform for marketing the tribal products • Basic e-Governance facility • Local talent Promotion • Established communication with the outside world
2	<p>Detailed description of the Project :</p> <p><u>SCOPE OF THE PROJECT</u></p> <ul style="list-style-type: none"> • The conceptual view of the proposed eTribe is illustrated in Figure 1. As the Figure 1 indicates, the transformation of an unstructured village into a smart village is centred around these three smart pillars. • IoT and AI technology components rest on these pillars, and these components in turn are the base for the layers of smart solutions. 	

- These solutions are embedded within a secure and safe layer and integrated with smart village interfaces. Smart solutions such as smart agriculture, smart health, smart education, smart networking and smart access to these solutions are implemented by providing smart and secure mobile apps.



Figure1: The conceptual view of smart tribal village implementation through eTribe

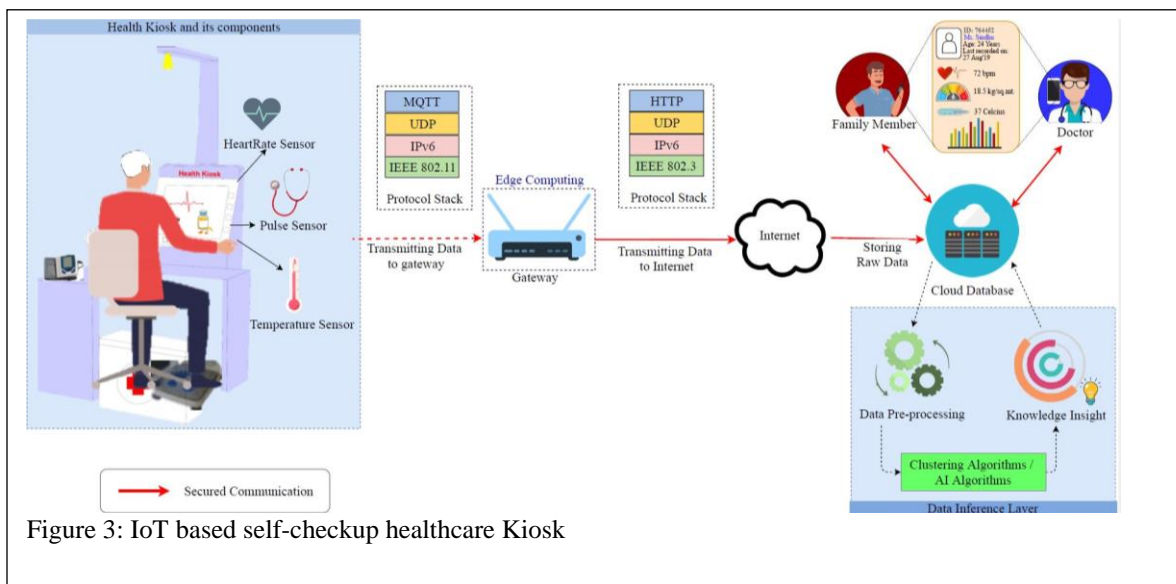
Under the multi-disciplinary application based CC&BT project “eTribe: Integrated Smart Tribal Eco-Platform- Chhattisgarh’s Tribal Village as a Proof of Concept”, followings will be developed:

(i) Development of ICT based Rural Health Care

- Implementation of "Theory-Driven Data Science" that will combine Biomedical Sensors, IoT, AI, and Conversational Interactive Mode of communication over Smartphones.
- A portable smart IoT-enabled MediKit having the capability to perform BMI, BP, ECG will be developed for checking the malnutrition, primary diagnosis in Anganbadi Center.
- An IoT-enabled smartphone-based anemia detection platform will provide the non-invasive screening of iron deficiency anemia.
- The front-end health workers will be trained to use the developed system.
- The IoT interface will incorporate features for doctors, primary health workers, and villagers in a single platform.
- Subsequently, AI/ML-based big data analytics will be deployed to automatically alert an expert with health complication, immediate medical attention and educating the rural people.

	<p>(ii) Development of an IoT-based Smart Harvesting Platform</p> <ul style="list-style-type: none"> • Development of Kisan Assist using IoT for monitoring crop growth, identifying plant disease using ML/DL. • IoT platform will ensure the quality checking of the well and pond water in regular basis and will update the village panchayat if there is any contamination. <p>(iii) Development of software and hardware prototype to enhance Education & Services</p> <ul style="list-style-type: none"> • ICT based network to promote education • e-Mandi platform for marketing the tribal products • Basic e-Governance facility <p>(iv) Development of Next Generation Opportunistic Network for enabling the IoT facilities</p>
3	<p><u>METHODOLOGY FOR DEVELOPMENT</u></p> <p>At first the focus will be for Identification of the problems associated with existing healthcare, agricultural, education and real time services for the population of the tribal villages. Subsequently, the proposed work has been divided into four major phases as follows :</p> <ol style="list-style-type: none"> Phase I: Design and prototyping of IoT enabled health kiosk for preliminary diagnosis to identify malnutrition, anemia care Phase II: Develop AI-ML based crop growth, disease prediction, water irrigation and management for smart farming Phase III: Design of Cloud-based secure storage and IoT based knowledge dissemination for basic education, services and e-mandi. Phase IV: Field testing and possible trials in collaboration with NGOs related organization in India. <p>Phase I: Design and prototyping of IoT enabled health kiosk for preliminary diagnosis to identify malnutrition, anemia care</p> <p>This phase aims to design an efficient IoT-AI based healthcare solution described in Fig. 3, which can mitigate the health challenges in rural India by extending the capabilities of front-line workers and improving coordination of care. A portable IoT-enabled MediKit will be developed to measure various physical and physiological parameters to identify the malnutrition and regular primary health check-up. The MediKit will consist of sensors like BMI, BP, and temperature and ECG. Parallel, a smartphone vision-based Anaemia detection platform will be implemented to diagnose</p>

Anaemia by scanning patient's eye. A proof of concept of this system has already developed by PIs, which will be extended and interfaced in IoT-cloud platform. Subsequently, AI algorithms will be implemented for continuous monitoring and proactive alertness with health complications and necessary medical attentions through IoT. Deployment of the proposed smart solution would enhance the proficiencies of primary health workers, who will screen the village patient regularly at Anganwadi center. This integrated IoT/AI/Smart Medical Sensors will ensure the sustainable healthcare solution for village healthcare in large scale. On top of this the project will create an impact to generate data on rural health and create health awareness among rural people through Smartphone/IoT platform. Further, the cloud interface will help the Govt. Agencies to analyze and predict the malnutrition, Anaemia, child and mother death, which will finally help to take necessary high-end health inference and assistance.



Phase II: Develop IoT-AI based crop growth, disease prediction, water irrigation and management for smart farming

Precision agriculture (PA) is a technology-enabled approach to farming management that observes, measures, and analyzes the needs of individual fields and crops. By allowing farmers to apply tailored care and manage water more effectively, it boosts production, improves economic efficiency, and minimizes waste and environmental impact. Next phase focuses on development of IoT technology for crop protection and management.

The Figure 4 shows the overview of the proposed system. The system will help to monitor different parameters such as soil moisture, temperature, rainfall, potential evapotranspiration, sunlight. Knowing these aspects in advance can help oenologists to

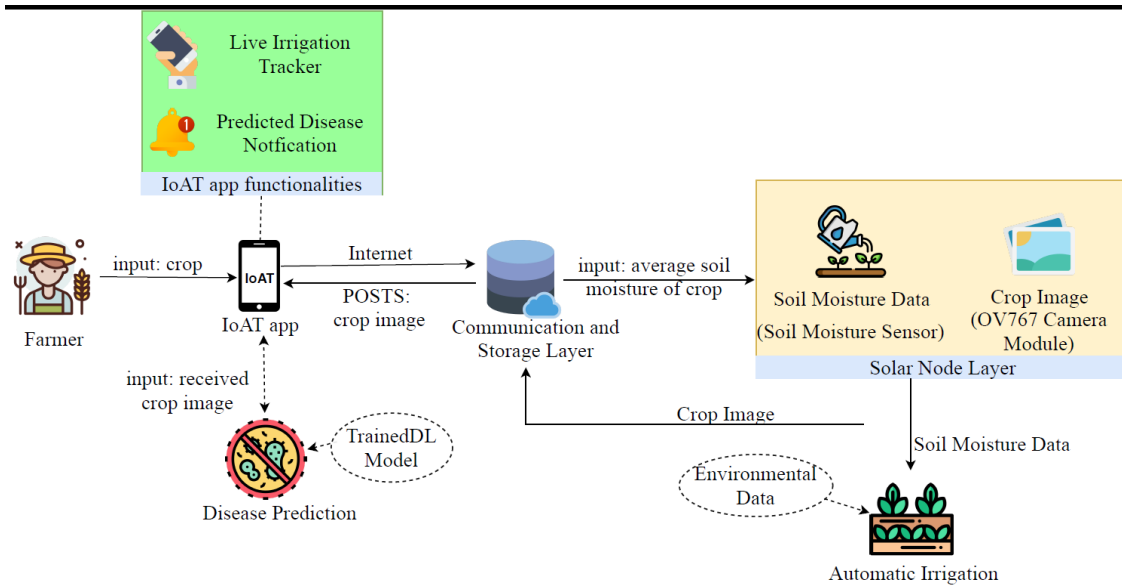


Figure 4: Overview of the proposed Kisan Assist system

better calibrate the different parameters which determine the character and quality of the crop. Several Waspnote Plug & Sense will be installed to control the parameters of the field:


- Temperature
- Humidity
- Atmospheric pressure
- Soil moisture
- Soil temperature
- Weather conditions (wind direction, wind speed and pluviometry)
- Leaf wetness

Further, the rapid identification of the diseases that affect the crops remains difficult in different parts of the world due to the limited availability of infrastructure. To help in agriculture, this research uses computer vision technology and deep learning methods for assisting prediction of diseases of crops. The Kisan Assist provides the farmer with a mobile app which can be used to predict the crop diseases by exploiting the high computing power and the camera sensors of the smartphones. It uses a system of IoT sensors, mobile communications, big data and analytics in the cloud. They all come together to help farmers use more precise amounts of fertilizer, water and other resources. Recommendations can be adjusted in real time to reflect changing weather conditions. Soil sensors and aerial images help farmers manage crop growth centrally, with automated detection systems providing early warnings of deviations from expected growth rates or quality.

The goals of the phase are:

- To develop a smartphone application which allows users to access the data in real time in a visual way with graphics, and also insert relevant information.
- To consolidate the current system and cloud infrastructure.
- To develop a easy to use user interface

	<p>Phase III: Design of Cloud-based secure storage and IoT based knowledge dissemination for basic education, services and e-mandi.</p> <ul style="list-style-type: none"> • In this Phase, a modular Platform is designing to provide services in integrated manner for various stake holders such as villagers, farmers, government officials and outside customers. Also, provides information on service status, feedback-based decision-making engine to integrate villagers and service provider's data; improved interaction mechanisms with interfaces through smartphones and desktop applications. • Teachers in rural areas may face certain challenges, such as limited training in using digital tools, exposure to technology, and apprehension of new modes of teaching. Therefore, it is crucial to impart adequate technology training to teachers. • Therefore, the preset project will used ICT-equipped hardware and software which will enables the access of online and offline learning materials. • Further, a small scale integrated network will be developed for addressing the several complain related to government services • The network will also interfaced the e-mandi concept for marketing the village made products on the open market. <p>Phase IV: Field testing and possible trials in collaboration with NGOs related organization in India.</p> <p>After prototyping of the individual module and successful integration of both hardware and software parts, a laboratory model will be developed. This model will be deployed in the field in the association with Govt. Department and NGOs. The entire system will be tested with real-life data.</p>		
4	<table border="1"> <tr> <td> <p>Specific manner in which know-how: generated here is envisaged to be translated into production, details regarding</p> <p>a) The end product (with specifications to be attained etc.)</p> <p>b) Availability of pilot production facility in the organization</p> </td><td> <p><u>End product:</u></p> <ul style="list-style-type: none"> ✱ Smart Village- TribeConnect is used for all Tribal villages, to enable their basic facilities, which they are not getting as of now. Leads to good health-index ✱ Enhanced health index- TribeConnect solutions are developed with the technology using IoT, help the continuous monitoring the health, Agricultural and Empowerment. This makes, the village population life's safe and comfortable. This will lead to ✱ Further, monitored data is collected and analyzed using AI technology to derive various insights. The derived insights can prevent the various health and prior suggestions to the formers to enhance the </td></tr> </table>	<p>Specific manner in which know-how: generated here is envisaged to be translated into production, details regarding</p> <p>a) The end product (with specifications to be attained etc.)</p> <p>b) Availability of pilot production facility in the organization</p>	<p><u>End product:</u></p> <ul style="list-style-type: none"> ✱ Smart Village- TribeConnect is used for all Tribal villages, to enable their basic facilities, which they are not getting as of now. Leads to good health-index ✱ Enhanced health index- TribeConnect solutions are developed with the technology using IoT, help the continuous monitoring the health, Agricultural and Empowerment. This makes, the village population life's safe and comfortable. This will lead to ✱ Further, monitored data is collected and analyzed using AI technology to derive various insights. The derived insights can prevent the various health and prior suggestions to the formers to enhance the
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		<p>productivity.</p> <p>★ Finally, developed solutions Health kiosks, KisanAssist are portable and robust can be deployed all tribal villages.</p>
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9	Information regarding specific intermediate milestones: (year-wise)	<p>1st year:</p> <ul style="list-style-type: none"> • Infrastructure development • Identification of Tribal village in Chhattisgarh for a implementation • Survey the root causes of Health, Agricultural and Empowerment and real time services for the population of the villages. • Prototype of Application Development for Service Design and Database Design • Initial Sensor node design • Outcomes: <ul style="list-style-type: none"> • Technical Report with its speciation's on Health, Agricultural, and Empowerment and real time services • Availability of Manpower and Infrastructure <p>2nd Year:</p> <ul style="list-style-type: none"> • Development of integrated Health monitoring system (Health kiosk/ Health ATM) for preliminary diagnosis to identify malnutrition, Anemia care. Health Kiosk/ Health ATM measure health using various sensors integrated as single unit. • Development of a Smart Harvest and Management system which consist of Automatic water irrigation systems, Smart phone app for disease prediction

		<p>forming and disaster prediction system. Kisan Assist prototype will be developed by including the following sensors soil moisture, pH, conductivity, etc.</p> <ul style="list-style-type: none"> • Development of intelligent software that is capable of collect data from the developed system, analyze, and early prediction of health disease and smart farming features. • Development of integrated one stop solution for Empowerment of Village people. • Outcomes: <ul style="list-style-type: none"> • Demonstration of IoT-AI based Robust and reliable Health Kiosk • IoT-AI based Robust and reliable Kisan Assist • One stop solution mobile app for various services at door step. • Publication <p>3rd Year:</p> <ul style="list-style-type: none"> • Testing and running of the developed prototypes on selected tribal village a pilot project. • Penetration testing • Dissemination of information regarding project output by organizing a workshop. • Capacity building of village people to use the developed prototypes with the help of NGO. • Preparation of final technical report.