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**Case Study Report on**

**“AI Assisted Tele-medicine KIOSK for Rural India”**

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**Abstract:**

In recent years, artificial intelligence (AI) has emerged as a transformative force, offering innovative solutions across various sectors. One such application with profound implications is AI-powered telemedicine, which holds great promise for addressing the healthcare disparities prevalent in rural India. With over 65% of the population residing in rural areas, equitable healthcare access remains a significant challenge due to limited infrastructure, healthcare personnel, and geographical barriers. AI-assisted telemedicine kiosks have emerged as a potential solution, providing rural residents with access to basic healthcare services, diagnostics, and health education. This report explores the concept, benefits, challenges, and recommendations for implementing these kiosks, underscoring their potential to revolutionize healthcare delivery in underserved regions. It also delves into the research problem's origin, ongoing work at national and international levels, objectives, and desired outcomes, offering a comprehensive view of the transformative potential of AI-assisted telemedicine kiosks in rural India.

**1.Introduction:**

The field of artificial intelligence (AI) has witnessed a transformative evolution in recent years, touching upon various aspects of our daily lives, including healthcare, education, transportation, and communication. In this age of technological advancement, one of the most promising applications of AI is in the realm of telemedicine, and its potential impact on rural India is of profound significance. Telemedicine, the delivery of medical services and information through electronic communication, holds the promise of bridging the healthcare disparities that have long plagued rural regions of India.

With a population exceeding 65% residing in rural areas, India faces a daunting challenge in ensuring equitable healthcare access. Rural India often grapples with a lack of medical infrastructure, limited healthcare personnel, and significant geographical barriers that hinder prompt medical attention. AI-assisted telemedicine kiosks offer a promising solution to these issues. These kiosks, equipped with AI-driven technologies, enable rural residents to access basic healthcare services and consultations without the need for arduous travel to distant healthcare facilities. Furthermore, these kiosks can assist with diagnostics, early disease detection, and health education, making them a potential game-changer for the overall health and well-being of rural communities.

This report delves into the concept, benefits, challenges, and recommendations for the implementation of AI-assisted telemedicine kiosks in rural India, emphasizing the transformative potential of this technology to reshape healthcare delivery in underserved regions.

**2.Literature & Problem Identification:**

The purpose of an AI Assisted Tele-medicine KIOSK for Rural India is to address the significant healthcare challenges faced by rural and remote areas in the country. This concept combines the following key elements:

Telemedicine: Telemedicine involves delivering healthcare services remotely, typically through audio and video communication. It allows patients to consult with healthcare professionals without physically visiting a medical facility.

Kiosk: The term "kiosk" refers to a small, standalone structure or booth, often equipped with a computer or touchscreen interface. In this context, the kiosk serves as a user-friendly interface for patients to access telemedicine services.

Artificial Intelligence (AI): AI is used to enhance the capabilities of the kiosk. AI algorithms can assist in diagnosing medical conditions, providing medical advice, and offering health information. AI can also enable data analysis, helping in early disease detection and patient management.[1][3]

Key features and functions of a KIOSK may include:

Video Conferencing: Patients can have virtual face-to-face consultations with healthcare providers, including doctors and specialists.

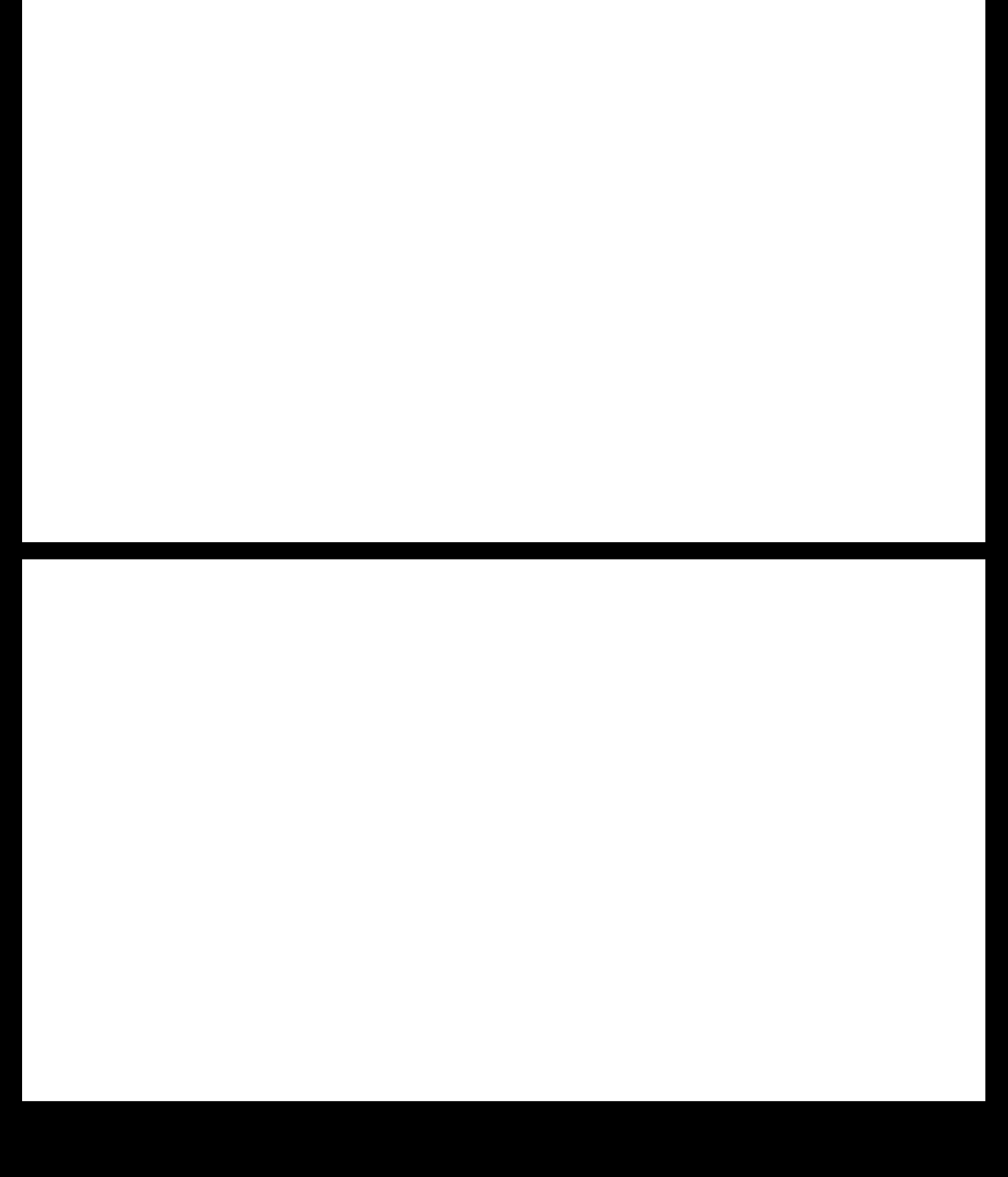
AI-Driven Diagnostics: AI algorithms can assist in assessing symptoms, making preliminary diagnoses, and recommending appropriate actions or referrals.

Health Information: Patients can access information on common health concerns, preventive measures, and healthy lifestyle practices.

Data Management: The kiosk can store patient medical records securely and facilitate follow-up consultations.

Medication Dispensing: In some cases, kiosks may offer prescription services and dispense common medications.

Emergency Services: Kiosks can connect patients to emergency services and provide first aid instructions.



**3.Origin of Research Problem:**

The research problem of "AI Assisted Tele-medicine KIOSK for Rural India" finds its origin in the pressing healthcare challenges faced by rural areas in India. It is rooted in the need to address the stark healthcare disparities between urban and rural regions. Let's explore the origin of this research problem in detail:

1. Healthcare Disparities in Rural India: The healthcare divide in India is well-documented. Rural areas often lack access to quality healthcare services, which results in delayed or inadequate medical attention. Healthcare facilities are scarce, and healthcare professionals are in short supply, making it challenging for rural residents to receive timely and appropriate care. The problem is exacerbated by the vast geographical expanse of the country, which can require hours or even days of travel to reach a healthcare facility.
2. Technological Advancements: Simultaneously, the last few decades have witnessed remarkable advancements in the field of artificial intelligence and telecommunications. These technological developments have opened up new possibilities for delivering healthcare services remotely. AI-powered systems can assist in diagnosing medical conditions and providing healthcare information, while telecommunications infrastructure has improved connectivity, even in remote areas.
3. Pandemic-Induced Acceleration: The COVID-19 pandemic highlighted the importance of telemedicine and remote healthcare services. Lockdowns and restrictions on movement underscored the need for telemedicine as a means of delivering care while maintaining social distancing.

4. Government Initiatives: The Indian government has recognized the need to improve healthcare access in rural areas and has launched initiatives to promote telemedicine, particularly in the wake of the pandemic. These initiatives create an environment conducive to the development and implementation of AI-assisted telemedicine kiosks.

1. Research and Innovation: Researchers, both in India and globally, have been exploring the potential of AI in healthcare and telemedicine. The intersection of AI and telemedicine for rural India presents a fertile ground for research and innovation.[4][5][8][11]

**4.Work at National & International Level:**

**4.1 National Initiatives:**

>National Telemedicine Mission (NTM): The National Telemedicine Mission (NTM) is a government-led initiative to provide tele-medicine services to rural areas. The NTM has partnered with several private companies to develop and deploy AI-assisted tele-medicine kiosks. For example, the NTM has partnered with the company Lifesense Health to deploy AI-powered tele-medicine kiosks in over 100 villages in India. These kiosks use AI to provide a range of services, including diagnosis, treatment advice, and monitoring of chronic diseases.

* AIIMS Telemedicine Project: The AIIMS Telemedicine Project is a collaboration between the All India Institute of Medical Sciences (AIIMS) and the company Practo. The project aims to provide tele-medicine

services to rural areas through AI-powered tele-medicine kiosks. The kiosks use AI to provide a range of services, including diagnosis, treatment advice, and monitoring of chronic diseases.

>Digital India Land Record Modernization Programme (DILRMP): The Digital India Land Record Modernization Programme (DILRMP) is a government-led initiative to digitize land records across India. The DILRMP has partnered with the company EMPOWER to deploy AI-powered tele-medicine kiosks in villages where land records are being digitized. These kiosks use AI to provide a range of services, including diagnosis, treatment advice, and monitoring of chronic diseases.

>Ayushman Bharat Digital Mission (ABDM): The ABDM is a government-led initiative to create a digital health infrastructure for India. The ABDM includes a component for the development and deployment of AI-assisted telemedicine kiosks in rural areas.

>Indian Council of Medical Research (ICMR) Telemedicine Initiative: The ICMR is a government-funded research organization that is working to develop and deploy AI-assisted telemedicine kiosks in rural areas. The ICMR is also working to develop training programs for healthcare workers on how to use AI-assisted telemedicine kiosks.

>Public Health Foundation of India (PHFI) Telemedicine Initiative: The PHFI is a non-profit organization that is working to improve public health in India. The PHFI is working to develop and deploy AI-assisted telemedicine kiosks in rural areas. The PHFI is also working to develop partnerships with private companies to deploy and manage AI-assisted telemedicine kiosks.[12]

**4.2 International Initiatives:**

>Bill & Melinda Gates Foundation: The Bill & Melinda Gates Foundation has funded a number of projects to develop and deploy AI-powered tele-medicine kiosks in rural India. For example, the Foundation has funded a project by the company eHealth Point to deploy AI-powered tele-medicine kiosks in over 1,000 villages in India. These kiosks use AI to provide a range of services, including diagnosis, treatment advice, and monitoring of chronic diseases.

>World Health Organization (WHO): The World Health Organization (WHO) is also working to promote the use of AI-assisted tele-medicine kiosks in rural areas. The WHO has developed a number of resources to help countries deploy and use AI-assisted tele-medicine kiosks effectively.

>International Telecommunication Union (ITU) Telemedicine Project: The ITU is a specialized agency of the United Nations that is working to promote the use of telecommunications and information and communication technologies (ICTs) for sustainable development. The ITU has a number of projects underway to develop and deploy AI-assisted telemedicine kiosks in rural India.

>World Bank Telemedicine Project: The World Bank is a multilateral development financing institution that provides loans and other forms of financial assistance to developing countries. The World Bank is also working to promote the use of telemedicine to improve access to healthcare in rural areas. The World Bank has a number of projects underway to develop and deploy AI-assisted telemedicine kiosks in rural India.

>USAID Telemedicine Project: The United States Agency for International Development (USAID) is the government agency responsible for administering civilian foreign aid. USAID is working to promote the use of telemedicine to improve access to healthcare in rural India. USAID has a number of projects underway to develop and deploy AI-assisted telemedicine kiosks in rural India.[10][11][12]



**5.Objectives:**

The overarching goal of this research endeavour is to provide evidence-based insights that can inform the future implementation of village-based digital health kiosk systems in rural settings, particularly in the context of healthcare delivery in India. To achieve this goal, a cluster-randomized trial has been designed with a set of specific objectives, each aimed at exploring and understanding different facets of the program's impact and effectiveness.

>Objective 1: This objective revolves around evaluating the program's influence on the quality of healthcare services and patient healthcare utilization. It seeks to determine whether the introduction of digital health kiosks enhances the quality of care received by patients, encompassing the early detection and appropriate referrals for infectious diseases and non-communicable diseases (NCDs). It also examines changes in patient healthcare utilization patterns, spanning primary care, tertiary care, specialized healthcare facilities, and the financial implications for village clinicians.[6][2]

>Objective 2: This objective focuses on the role of monetary incentives for clinicians tied to their utilization of the digital kiosk system. It explores whether financial incentives motivate healthcare providers to engage more extensively with the kiosks and how this engagement subsequently affects healthcare delivery and patient outcomes.

>Objective 3: The study considers the impact of demand-side social marketing strategies on the adoption of the kiosk system. It assesses the effectiveness of community-based initiatives and awareness campaigns in promoting the use of digital health kiosks, shedding light on the dynamics of community engagement and its effects on healthcare utilization.

>Objective 4: Here, the research examines the interaction between clinician incentives and demand-side marketing strategies. It seeks to elucidate whether the combined effects of these two approaches result in a synergy or tension and how this interaction influences the utilization of the kiosk system, particularly across different incentive levels.

>Objective 5: The cost-effectiveness of various program design options is evaluated, allowing for a comparative analysis of the different investments, resource allocations, and program modifications. This informs decisions on which design options are the most efficient and economically sustainable while achieving desired outcomes.

>Objective 6: Lastly, the study explores how the program impacts key population groups identified by public health policy, such as the elderly, pregnant women, and children. It seeks to discern whether the

effects of the program vary among these unique demographic segments and how it addresses their specific healthcare needs.[

**6.Desired Outputs/Outcomes:**

The desired outputs and outcomes of the "AI Assisted Tele-medicine KIOSK for Rural India" project are multi-faceted and encompass a range of short-term and long-term goals. These outputs and outcomes are intended to address the unique healthcare challenges faced by rural India. Here are the key desired results:

**6.1 Short-Term Outputs:**

1.Deployment of Telemedicine Kiosks: The project aims to establish a network of AI-assisted telemedicine kiosks in rural areas, ensuring their physical presence and operational functionality.

2.Improved Access: In the short term, the project seeks to provide immediate and improved access to basic healthcare services for rural residents, reducing the need for long and arduous journeys to distant healthcare facilities.

3.Initial Training: The project will conduct training programs to familiarize users and healthcare providers in rural areas with the kiosk's technology, ensuring they can effectively utilize the system.

4.Community Awareness: Short-term outcomes include heightened awareness among rural communities about the benefits of telemedicine and the availability of kiosk services.

5.Increased Healthcare Utilization: The project aims to see an increase in healthcare utilization through the telemedicine kiosks, with patients using these facilities for consultations, diagnostics, and health-related information.

**6.2 Intermediate Outcomes:**

1.Quality Healthcare: The project endeavors to improve the overall quality of healthcare delivered through the kiosks, ensuring appropriate referrals, accurate diagnostics, and access to reliable medical information.

2.Disease Detection and Management: Intermediate outcomes involve the effective use of AI for early disease detection and improved management of both infectious diseases and non-communicable diseases (NCDs).

3.Reduction in Healthcare Disparities: The project aims to reduce healthcare disparities in rural areas, improving the health outcomes of the population.

4.Financial Impact: Intermediate outcomes may include financial benefits, such as cost savings for rural families due to reduced travel expenses and lower healthcare costs.

**6.3 Long-Term Outcomes:**

1.Sustainable Telemedicine Ecosystem: The project envisions the establishment of a sustainable telemedicine ecosystem in rural India, with continued operation and expansion of kiosks.

2.Improved Health Indicators: Over the long term, the project aims to contribute to improved health indicators, including reduced mortality rates, better disease management, and increased life expectancy in rural areas.

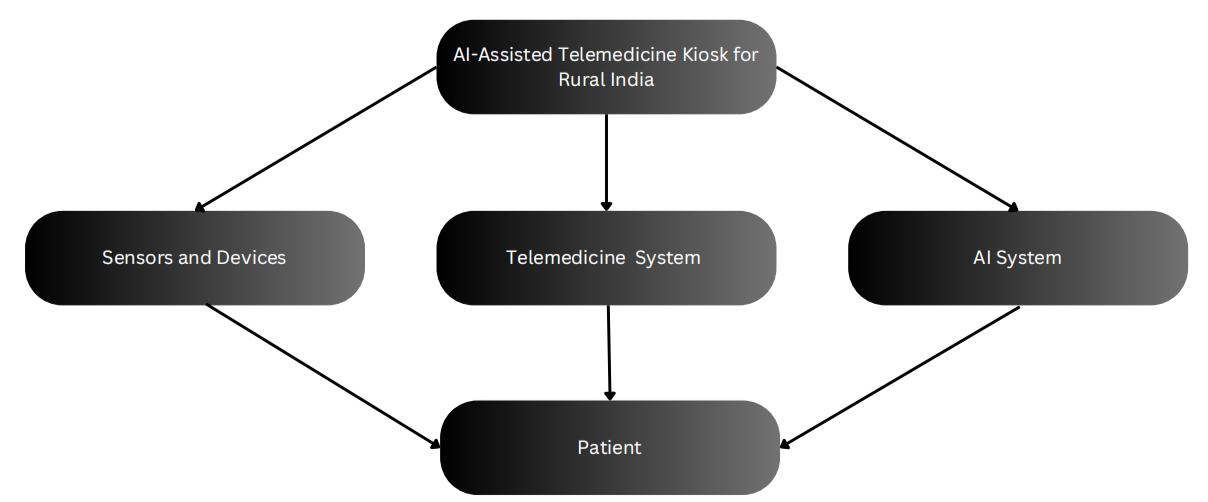
3.Community Empowerment: The project seeks to empower rural communities by providing them with a reliable and accessible healthcare resource, enhancing their overall well-being and quality of life.

4.Economic Benefits: Long-term outcomes may include economic benefits, such as increased productivity and reduced economic burden on families due to better health outcomes and reduced healthcare costs.

5.Government Policy Impact: Successful implementation of telemedicine kiosks could influence government policies, leading to broader support for telemedicine and rural healthcare infrastructure.

6.Research and Innovation: The project may stimulate further research and innovation in the field of AI-assisted telemedicine, benefiting not only rural India but also healthcare practices globally.[9]

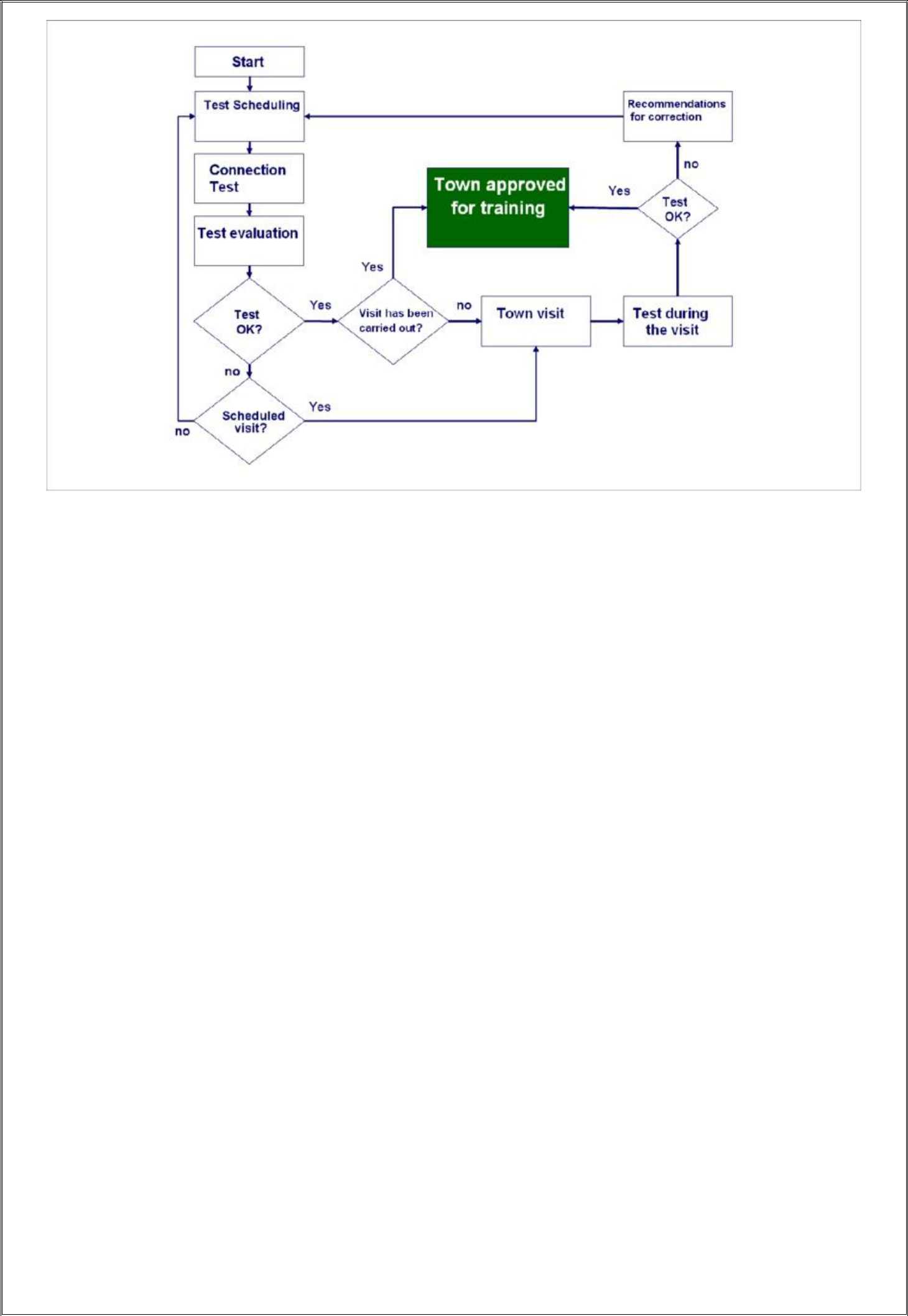
**7.Proposed Methodology:**



Sensors and devices: The kiosk will be equipped with a variety of sensors and devices that will allow healthcare workers to remotely monitor and diagnose patients. These sensors and devices may include a camera, microphone, stethoscope, blood pressure monitor, and thermometer.

Telemedicine system: The kiosk will also have a telemedicine system that will allow patients to consult with doctors and other healthcare professionals without having to travel to a hospital or clinic. The telemedicine system will allow patients to videoconference with healthcare professionals and to send and receive medical data.

AI system: The kiosk will also have an AI system that will be used to assist healthcare workers in diagnosing and treating patients. The AI system will be trained on a large dataset of medical data, and it will be able to identify patterns and trends that may not be obvious to human healthcare workers.



The workflow is designed to be flexible and can be adapted to the specific needs of the community. For example, if there are not enough trained healthcare professionals available to provide care to patients using the kiosks, the workflow may be modified to allow patients to complete the test and receive recommendations for correction remotely.

The workflow can also be integrated with other healthcare systems, such as electronic health records (EHRs) and patient portals. This can help to ensure that patients receive seamless care, regardless of where they access healthcare.

1.Test scheduling: The patient schedules an appointment to use the telemedicine kiosk. This can be done online, by phone, or in person.

2.Connection test: The patient arrives at the kiosk and performs a connection test to ensure that the kiosk is working properly and that the patient has a good internet connection.

3.Town approved for training: The patient's town must be approved for training before the patient can use the kiosk. This is to ensure that there are enough trained healthcare professionals available to provide care to patients using the kiosks.

4.Town visit: If the patient's town is approved for training, the patient can then schedule a town visit. This is a visit to the kiosk where the patient will meet with a trained healthcare professional in person.

5.Test during the visit: During the town visit, the patient will complete a test to assess their health condition. The healthcare professional will use the results of this test to make recommendations for the patient's care.

6.Recommendations for correction: If the patient's test results indicate that they need medical care, the healthcare professional will provide recommendations for correction. These recommendations may include medication, lifestyle changes, or further testing.

7.Test OK? If the patient's test results indicate that they are healthy, the healthcare professional will mark the test as OK.

8.Visit has been carried out? If the patient has completed a town visit, the visit will be marked as completed.

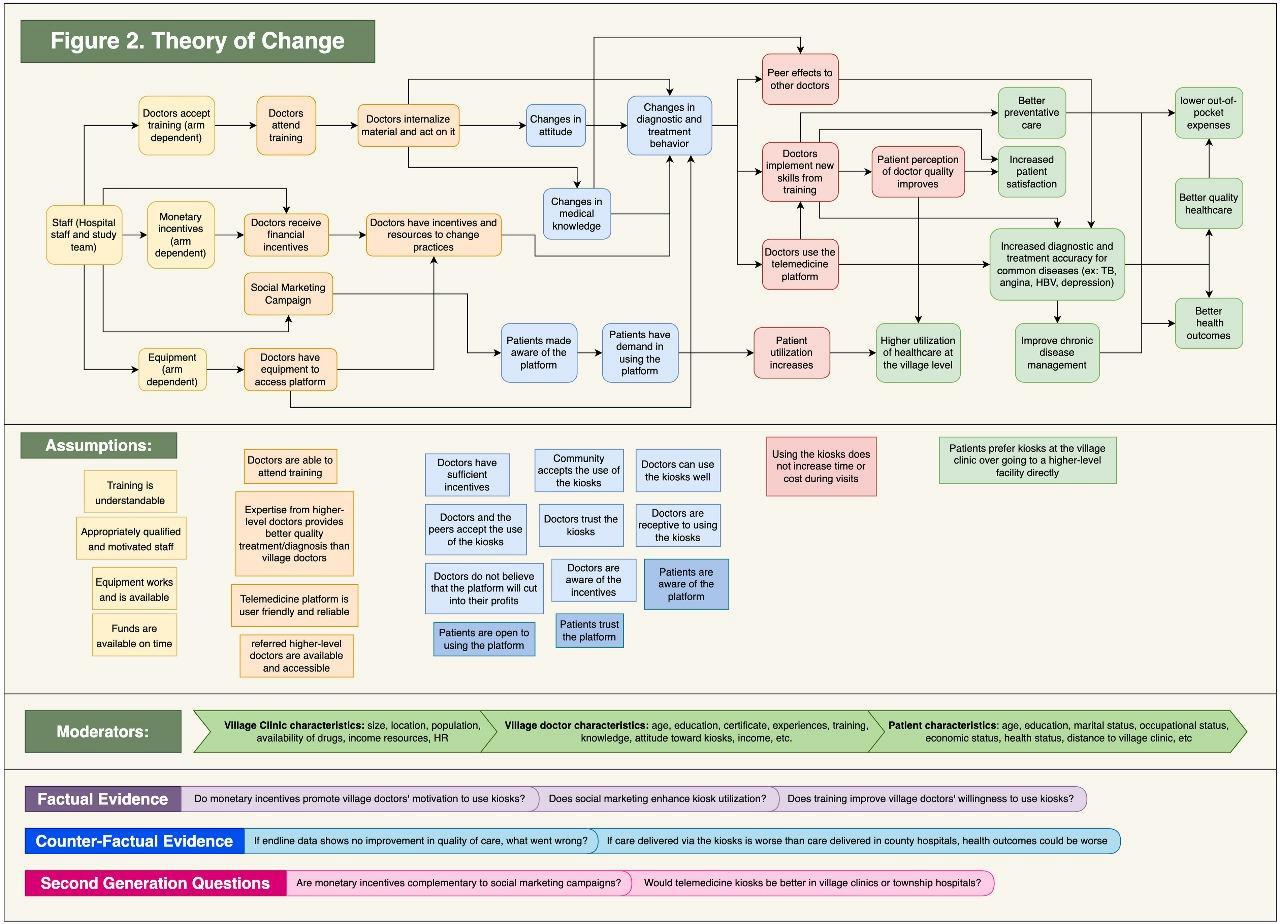
9.Scheduled visit? If the patient has scheduled a town visit, the visit will be marked as scheduled.

10.Test OK? If the patient's test is OK, the workflow will end.

11.No: If the patient's test is not OK, the workflow will restart at step 5.

Example:

A patient in a rural village in India schedules an appointment to use the telemedicine kiosk. The patient arrives at the kiosk and performs a connection test. The patient's town is approved for training, so the patient schedules a town visit. During the town visit, the patient completes a test to assess their health condition. The healthcare professional uses the results of this test to make recommendations for the patient's care. The patient's test results indicate that they need medication, so the healthcare professional provides a prescription for the medication. The patient is then able to pick up the medication at a local pharmacy.



The following is the flow of data through the AI-assisted telemedicine kiosk:

>The patient enters the kiosk and is greeted by the AI system.

>The patient selects the type of healthcare service they need (e.g., general consultation, specialist consultation, etc.).

>The AI system collects the patient's medical data (e.g., vital signs, symptoms, medical history, etc.).

>The AI system analyses the patient's medical data and provides a preliminary diagnosis.

>The patient may then videoconference with a healthcare professional to discuss the diagnosis and get treatment recommendations.

>The healthcare professional may also use the kiosk to remotely monitor the patient's vital signs and other medical data.

**8.References:**

1. Weibin Cheng, Zhang Zhang, Samantha Hoelzer, Weiming Tang, Yizhi Liang, Yumeng Du,corresponding author, Hao Xue, Qiru Zhou, Winnie Yip, Xiaochen Ma, Junzhang Tian, corresponding author and Sean Sylvia. Evaluation of a village-based digital health kiosks program: A protocol for a cluster randomized clinical trial. Published online 2022 Oct 5. doi: 10.1177/20552076221129100.
2. Kumar Gandharv, AI for Good - AI bringing digi-healthcare to the doors of rural India, Published online on Apr 22, 2022.
3. Adam Ang, Roundup: Docty setting up 100 telehealth kiosks in India and more briefs, Published on April 22, 2022 05:06 AM.
4. Raj Kishor Kustwar, Suman Ray, eHealth and Telemedicine in India: An Overview on the Health Care Need of the People, August 2020Journal of Multidisciplinary Research in Healthcare 6(2):25-36, DOI:10.15415/jmrh.2020.62004, LicenseCC BY 4.0
5. HENG YU AND ZHIQING ZHOU, Optimization of IoT-Based, Artificial Intelligence Assisted Telemedicine Health Analysis System, Received May 28, 2021, accepted June 6, 2021, date of publication June 10, 2021, date of current version June 18, 2021.
6. Centre for Innovation and Bio-Design in association with Sri Venkateshwara Indo Global Medicare (SVIG) & RMS. Una (Himachal Pradesh) and Civil Hospital Sangrur (Punjab). April 2020 to April 2021.https://youtu.be/RvSuEjYy\_1c?si=RTF9UWCdWNWSlRex.
7. Mayur Ramgir, mramgir@zonopact.com, CEO, Zonopact, Inc. & Founder of EverythingTech, DOI:.29322/IJSRP.9.10.2019.p9405 http://dx.doi.org/10.29322/IJSRP.9.10.2019.p9405, Internet of Things Powered Automated AI-Enabled Medical Kiosk.
8. Scerbo, M. W. (2016). Simulation in Healthcare. Simulation in Healthcare: The Journal of the Society for Simulation in Healthcare,11(4), 232-235. doi:10.1097/sih.0000000000000190
9. Banerjee, S., Bhattacharya, A., & Sen, S. (2018). Healthcare IoT (H-IoT). Machine Learning and IoT,247-263. doi:10.1201/9781351029940-15
10. Spector, L. (2006). Evolution of artificial intelligence. Artificial Intelligence,170(18), 1251-1253. doi:10.1016/j.artint.2006.10.009
11. Telemedicine Kiosks for Rural India: A Review by the Indian Journal of Public Health (2021)
12. AI-Assisted Telemedicine Kiosks in Rural India: A Case Study of the Sehat Saathi Program by the World Health Organization (WHO) (2018).