Randomized Control Trial for Determining Effectiveness of Telemedicine Service Grid for Animal Healthcare

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1. Introduction

Technology advancements today make it possible to usher in an era of AI and IoT based healthcare management system for animal health care. Use of personal smart phone, cloud servers, database of treatment solutions for disease symptoms, networked infrastructure facilities and a pool of resources for consulting are structurally sufficient to extend the technology advantage to the owners of animals. What it could evolve is a system for animal care that would optimize the resources and infrastructure efficiently, minimize the difficulties of owners seeking healthcare for their animals, monitor implementation of animal healthcare management in the society and generate reports for information dissemination and general management.

Telemedicine, also called tele-health, in medical field is concerned with remote delivery of healthcare services, such as consultations or health reports, over the telecommunications infrastructure. It is a well-accepted practice in modern medicine and more than half of the hospitals in the US use it in one way or other. It could be used in animal husbandry and has potential for huge benefits, especially for the rural population. One existing model uses a mobile van where all devices for treatment are set up. The van is taken to the required location along with the clinical team. Video conferencing is used for connecting with expert doctors, whenever needed. This model, though ideal for many critical situations, is expensive both in terms of cost involved and the number of cases that can be handled in a day. An alternate and cheaper approach is to use mobile phones and cloud computing that replace the commuting part. In this, all stake holders are connected in a grid as illustrated in Fig 1.

2. Telemedicine grid

The main components of the telemedicine grid are (a) A web portal running from a cloud server; (b) A call centre that act as a control centre to handle all cases from a geographical area – typically a District (c) A mobile application (PDB) provided to the owner of the animal (d) Another mobile application (CDB) provided to the veterinary doctors (e) A mobile tele-unit packaged inside a suitcase that can be carried to the site if a home visit is warranted.

The call centre is ideally managed 24x7 by an experienced operator – not necessarily a doctor. This is the first point of contact from the afflicted animal caretaker. It has the Video Conferencing (VC) functionality. Using the VC function provided in the PDB mobile application, the caretaker can show the condition of the afflicted animal. This will help to plan management of the case. The mobile applications (PDB and CDB) are provided to all stake holders. With the click of a button, they can communicate with each other in Video, Audio or text mode. These may be later replayed for subsequent analysis. The doctors in the veterinary hospital are provided with web-screens that has VC facility. They will be able to provide expert advice after viewing the case.

The portable service kit consists of a Tablet PC and associated peripherals like close examination camera and digital thermometer, packaged inside a trolley bag. It also has containers to store a limited set of medicines. The whole system with devices should ideally weigh less than 10 kg and ensure portability. It should be possible to set up and made fully operational within 10-20 minutes.

A typical use case scenario starts with the affected party contacting the call centre using a smart phone. The Control Node picks up the call, listens to the issue, explains the scheme and in case there is good

mobile data connectivity at the receiver's location, sends an SMS. Clicking on a link provided in the SMS will download and set up the PDB mobile App in the smart phone. With this, the phone becomes part of the grid. Using the VC functionality and the back camera of the phone, the condition of the animal can be shown. Based on the seriousness of the case, the options to choose are (a) Get a veterinary doctor to join the VC and to provide an on-line advise or, (b) Schedule a remote appointment with a veterinary hospital wherein the animal could be shown to a team of doctors using the mobile camera or, (c) Schedule a home visit by a veterinary helper who will visit the location along with the portable service kit to provide more detailed examination that will involve the remote veterinary hospital staff or, (d) advise the care taker to physically transport the animal to the hospital.

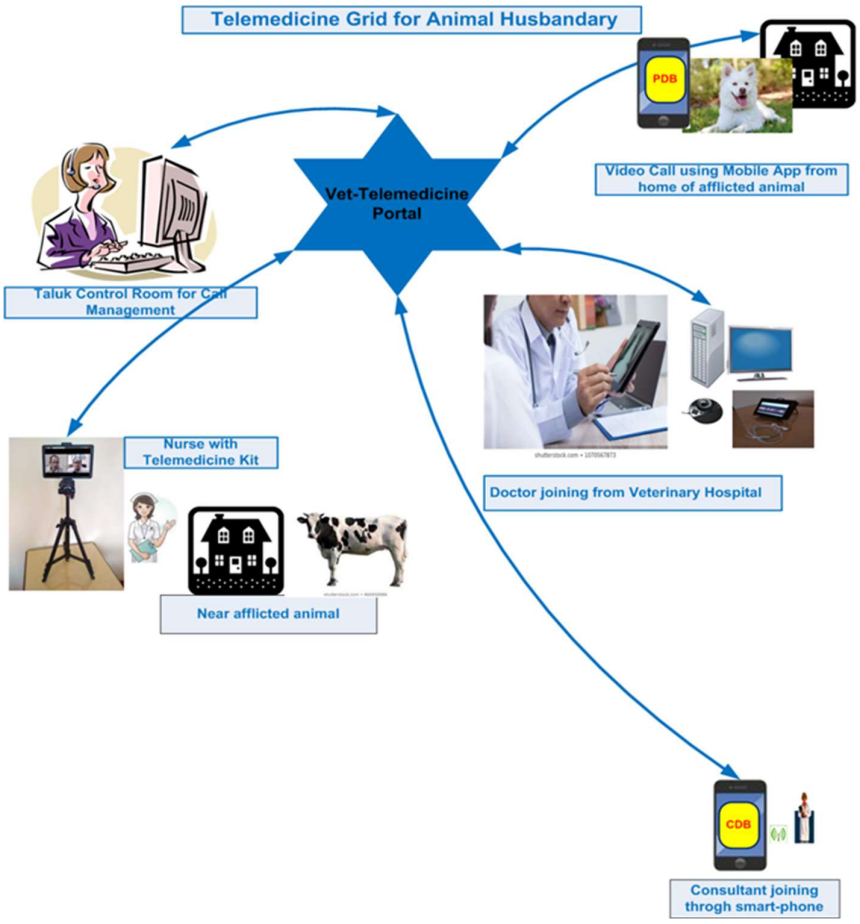

Fig 1: Architectural View of Tele-medicine Care Grid for Animal Husbandry

3. Advantages of the system

The main advantages of the system are the following:

- It will reduce the requirement of actual transportation of the animal to the hospital for a significant percentage of the cases, which will be a huge advantage to the owner
- Since all veterinary hospitals and doctors becomes part of the grid, the geographical boundary for treatment vanishes and any one in the grid can virtually offer their service. This facilitates effective load balancing across the nodes in the grid

- The time to start treatment reduces significantly since the control node can be contacted over the internet on detecting the onset of the issue
- The backup history of treatment is automatically made online in the cloud server enabling all doctors in the network view it
- The network can start small – with just a control node, one hospital, and all doctors in it – and expand seamlessly as per increase in the requirements.

4. Implementation Aspects

The study on the effectiveness of the above system for improvement of income levels of the beneficiaries, especially in the socially backward groups, is best done by conducting a Randomized Control Trial (RCT) involving a sufficiently large population. A pilot project could cover all the veterinary hospitals and dispensaries in a geographical area. The RCT could select a specified percent of the centers for inclusion in the pilot project and these centers are to be provided with telemedicine kits for remote consultation. A field level staff in the center will carry the kit to the service seeker at the location of the afflicted animal and the available doctor in any of the veterinary hospital will provide the remote consultation.

A Statistical analysis of the data generated will bring out the extent of the economic and social benefits of the scheme. This will help policy makers to take a decision on its large-scale roll-out.

The pilot project will typically have three phases. The Pre-trial phase will collect data of beneficiaries and the scheme for RCT will be laid out and these will take upto three months, depending on the count of beneficiaries. The Trial phase will be completed in 11 months. The third phase is Post-trial phase expected to complete in 1.5 months.

During the trial, a telephonic help desk that runs on 9 to 5 basis on all days (including holidays) will have to be operational at a common control node. It will take up customer calls from the service seekers from the entire population and based on the RCT allotment scheme and schedule the telemedicine sessions corresponding to locations where the kits are distributed. This is a web-based system and the data will automatically flow into the DBMS. Through this process, it will collect data of the service seekers, type of reported problems from them and the service provided by the tele-consultation system and its efficacy. This will be subjected to detailed statistical analysis in the post-trial phase.

The dashboard set up for the above will have an analytic section for real time monitoring of the operational aspects. It will also have a report generation section for automated periodic reports as well as on-demand reports. A typical dashboard will not only have detailed information about the progress of the trial, but also details like animal husbandry and livestock statistics, live results of the operations of Animal Husbandry department, and real time availability of resources. It will display the engagement level of resources and the number of cases that requests for attention. These are dynamic entities, and the analysis solution will optimally distribute the services to the less engaged resources and facilities. There will be continuous flow of data relevant to the stakeholders which can be effectively used for optimizing the output level. Being a web-based system, it is inherently scalable and could be accessed over the internet by anyone having the access rights.

*(Note: This write-up is prepared from a project proposal submitted by Kerala Statistical Institute (**KSI**) to Animal Husbandry Department, Government of Kerala in 2019. Any response to this note may be mailed to secretary@ksinstitute.org)*