Proposal

For

Blood Bag Traceability and Citizen

Interaction portal for promoting

speedy, safe & voluntary blood donation



Kerala Development of Innovation and Strategic Council

(K-DISC)

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ABBREVIATIONS

| BSC BSCU | Blood Storage Centre Blood Storage and Collection Unit |
|-------------|---|
| CC | Collection Centre |
| DHS | Directorate of Health Services |
| GH | General Hospital |
| FFP | Fresh Frozen Plasma |
| K-DISC | Kerala Development and Innovation Strategic Council |
| KSACS | Kerala State Aids Control Society |
| KSUM | Kerala Startup Mission |
| PC | Packed Cells |
| PRC | Packed Red Blood Cells |
| SDC | State Data Centre |
| ТНQН | Taluk Head Quarters Hospital |
| THQHP | Taluk Head Quarters Hospital Parassala |

1 Organization/Company Profile

K-DISC is a strategic think-tank and advisory body constituted by the Government of Kerala. It aims at bringing out path-breaking strategic plans that reflect new directions in technology, product and process innovations, social shaping of technology and creating a healthy and conducive ecosystem for fostering innovations in the State. In the sphere of development, K-DISC is promoting and initiating new projects in Emerging Technologies such as Block Chain, Internet of Things, Machine Learning, Artificial Intelligence, Robotics and soon that would enable transparent and cognitive advances in various departments of the state Government and deliver the ultimate benefit to the citizens. K-DISC would facilitate with different government departments that may need any of these technological advances to solve their critical problems and to arrive at the proof of concepts stage with adequate technical and financial resources in order to promote innovation. Also, K-DISC will ease the implementation by overseeing of the same.

2 Introduction

2.1 Need for the Project

Blood transfusion is identified as one of the eight key life-saving functions in comprehensive emergency obstetric care. One of the major causes of maternal death is due to hemorrhage and blood should be available to manage these cases. Anaemic patients also require an immediate blood transfusion in complicated cases. Accidents and other emergency cases also require immediate blood transfusion to save lives. The ready availability of a matching group of blood should be ensured across all geographies, whether urban or rural. To do this, we need to set up Blood Collection Centres and cover all geographies of the state. Blood collection centres need facilities for screening. This requires huge capital cost for initial setup, as well as the recurring cost for running the facility. Also, in these locations, there should be a minimum number of patients receiving blood as well as donors donating blood daily. This is an unviable proposition. Hence an effective alternative system is being established by designating a blood collection centre with all facilities for collecting and screening blood, and making relevant blood products and setting up peripheral Blood storage centres in selected evenly distributed Blood Storage Centres. Blood/blood products are transported from Blood Collection Centre (BCC) to Blood Storage Centres (BSC) on regular periods as per their request. For maintaining temperature as per WHO guidelines, whole blood needs to be always stored in temperatures from 2°C to 6°C. With the transportation involved in the Blood Collection Centre to Blood Storage Centre hub and spoke system, it is important to ensure safe blood service to the patients.

In the BCC-BSC hub & spoke system, whole blood/Packed Red Blood Cells are removed from BCC refrigerators and loaded onto the ice boxes for transportation to BSC. Upon loading the icebox, the temperature is maintained at less than 6°C throughout its transportation. On reaching BSC, blood bags are removed from the icebox and transferred to Refrigerator at BSC. As per guidelines, blood bags should be consumed within 30 minutes of removal from the storage area (i.e., blood bags should not be in

ambient temperature for more than 30 minutes). Hence for safe blood service, the following needs to be ensured:

(i) Time taken to transfer blood bags from BCC Refrigerator to icebox shall be less than 30 minutes.

(ii) Temperature of blood bags during transportation to be less than 6°C

(iii) Time taken to transfer blood bags from Icebox to BSC Refrigerator shall be less than 30 mins

(iv) BCC refrigerator temperature is to be maintained < 6°C

(v) BSC refrigerator temperature is to be maintained < 6°C

End to end traceability of blood bag temperature is essential in this system. Further, hence the state of each blood bag throughout its journey should be addressed to eliminate avoidable maternal mortality and morbidity. Blood traceability and effective blood bank management will result in the smooth running of blood banks and Blood Storage Centres (BSC). Temperature monitoring of individual blood bags is another important parameter which has an impact on the quality of stored blood and their final safe usage. BSCs are the answer to make blood available to most of the locations in India. BSC collects blood from the mother blood bank, and then store it in their premises and issue to the patients. As per the proposal, establishing the reliability of blood products will increase confidence in increasing inventory of blood products in BSC. Hence smooth functioning of BSCs can result in saving many lives.

3 Project Objectives

- To establish traceability of blood bags with respect to storage temperature condition from donor to the recipient
- To identify areas for intervention for system improvement and digitize the workflow of Blood Bank and Storage Centre operations.
- State-wide implementation to digitize and track all collection centres and storage centres.

4 Scope of the Project

The scope of the project involves the following:

- 1. Data Acquisition automation at forty-one Blood Collection Centers of the state
- 2. Data Acquisition automation at fifty-seven Blood Storage centers of the state.
- 3. Installation and commissioning of Mobile Blood Bag Temperature Trackers in all Blood Collection and Storage Centres of the State.
- 4. Centralized Application hosted at the State Data Centre (SDC)
- 5. Develop a citizen interaction portal interfacing with Voluntary donor apps, private hospital blood banks etc to publish blood availability to citizens and collect citizen requirements safely, transparently and securely. This promotes safe, voluntary blood donation.

The proposed project is designed to suit the smooth functioning of all blood collection centres and blood storage centres. For smooth functioning both hardware infrastructure and software for management information system for blood collection centres and blood storage centres are required. Further dissemination of relevant "need to know" information and interfacing with external systems for citizen welfare service are also essential. The scope requirements are further elaborated in the ensuing sections in detail.

4.1 Data Acquisition Automation at forty-one Blood Collection Centers of the state.

As part of the project, forty-one blood collection centres are to be considered for implementation as shown in Table 1 below.

| Table 1. List of Govt. Blood Collection Centres | | | | | |
|---|--|------------|--|--|--|
| SI.No. | Name of the Blood Bank | District | | | |
| 1 | Medical College Hospital | Alappuzha | | | |
| 2 | Women & Children Hospital | Alappuzha | | | |
| 3 | General Hospital, Alappuzha | Alappuzha | | | |
| 4 | Govt. Medical College Hospital | Ernakulam | | | |
| 5 | General Hospital | Ernakulam | | | |
| 6 | District Hospital | Ernakulam | | | |
| 7 | Govt. Medical College Hospital (District Hospital) | Idukki | | | |
| 8 | Govt Medical College Hospital, Pariyaram, Kannur | Kannur | | | |
| 9 | District Hospital | Kannur | | | |
| 10 | General Hospital, Thalassery | Kannur | | | |
| 11 | Malabar Cancer Centre | Kannur | | | |
| 12 | District Hospital, Kanhangad | Kasargod | | | |
| 13 | General Hospital Kasargo | | | | |
| 14 | Medical College Hospital | Kollam | | | |
| 15 | District Hospital | Kollam | | | |
| 16 | Taluk Head Quarters Hospital | Kollam | | | |
| 17 | Taluk Head Quarters Hospital | Kollam | | | |
| 18 | District Hospital | Kottayam | | | |
| 19 | Medical College Hospital | Kottayam | | | |
| 20 | General Hospital (Beach) | Kozhikode | | | |
| 21 | Govt. W & C Hospital | Kozhikode | | | |
| 22 | Medical College Hospital | Kozhikode | | | |
| 23 | District Hospital | Kozhikode | | | |
| 24 | Medical College Hospital | Malappuram | | | |
| 25 | Govt Hospital | Malappuram | | | |

| 26 | District Hospital Malapp | | |
|----|--|----------------|--|
| 27 | District Hospital | Palakkad | |
| 28 | Taluk Head Quarters Hospital, Mannarkad | Palakkad | |
| 29 | General Hospital | Pathanamthitta | |
| 30 | Taluk Headquarters Hospital | Pathanamthitta | |
| 31 | General Hospital | Thrissur | |
| 32 | Medical College Hospital | Thrissur | |
| 33 | General Hospital | Trivandrum | |
| 34 | Medical College Hospital | Trivandrum | |
| 35 | Regional Cancer Centre | Trivandrum | |
| 36 | Sree Chitra Thirunal Institute for Science & Technology | Trivandrum | |
| 37 | Taluk Headquarters Hospital | Trivandrum | |
| 38 | W & C Hospital | Trivandrum | |
| 39 | District Hospital | Trivandrum | |
| 40 | District Hospital | Wayanad | |
| 41 | Taluk Headquarters Hospital | Wayanad | |

Table 1: List of Govt. Blood Collection Centres

Architecture of the system proposed to be implemented at each of the Blood Collection Centres is illustrated in Figure 1 below.



Based on the architecture given in Figure 1 above; the process, data collection, and reports generation from the Management Information System will be as detailed below:

4.1.1 At Node 1:

1. Initially, the donor arrives at the Blood Bank, and fills in the donor form. The donor will give the filled donor form to the counselor of the Blood Bank. This form has to be replicated in the web portal to be developed, wherein the counselor can update the details once the initial procedures are over. The following data (may not be limited to) will be collected in the system;

(Section A – Personal details)

- Donor name
- Age
- phone number,
- address and pincode
- occupation
- marital status
- gender
- blood group
- champ name
- education
- frequent donor/not

(Section B - Questionnaire)

- Diabetic: Yes/No
- Drug Addiction: Yes/No
- Heart Diseases: Yes/No
- Aspirin Intake (Last 3 Days): Yes/No
- Hypertension: Yes/No
- Transfusion-transmitted Disease: Yes/No
- Respiratory Disease/Asthma: Yes/No
- Malaria within 3 years: Yes/No
- Mental illness/Schizophrenia: Yes/No
- Typhoid one year after recovery: Yes/No
- Convulsion/Epilepsy: Yes/No
- Tuberculosis/Leprosy: Yes/No
- Liver Disease/Renal Disease: Yes/No
- Skin Diseases: Yes/No
- Endocrine disorders: Yes/No
- Major surgery within one year: Yes/No
- Cancer: Yes/No
- Tattoo/Ear Piercing (within 6 months): Yes/No
- Prolonged Bleeding from wounds: Yes/No
- Blood Transfusion within 6 months: Yes/No
- Polycythemia Vera: Yes/No
- Immunization Within 15 days: Yes/No
- Jaundice within one year: Yes/No
- Anti-Rabies vaccine within 1 year: Yes/No
- Allergy: Yes/No
- recent Medication: Yes/No
- Hepatitis B: Yes/No
- Antibiotic within 3 days: Yes/No
- Alcohol intake within 24 hrs: Yes/No
- Did you get adequate Sleep yesterday: Yes/No
- Persons who injected themselves with drug, have multiple sex partners or same sex partners are more likely to be infected with virus causing AIDS: Do you practice the above? Have you been tested for AIDS: Yes/No
- In the last 6 months have you experienced any of the following
 - Persistent Cough: Yes/No
 - Loss of weight: Yes/No
 - Unexplained Fever: Yes/No
 - Diarrhea: Yes/No
 - Swollen Glands: Yes/No
- Do you want to know the test report: Yes/No

(Section C- Women Donors Check List)

- Have you had abortion or pregnancy in the last 3 months: Yes/No
- Are you breastfeeding your child: Yes/No
- Are you undergoing menses: Yes/No
- 2. On completion of the counselling procedures, the counsellor can categorize the donor (if the donor needs to be categorized under deferred list, he/she

can easily do the same). Once the donor details are entered, the system crosschecks with the already available defer list for any non-preferred blood donations.

4.1.2 At Node 2

1. A nurse or a technician who does the phlebotomy will assign the blood bag ID to the bag and collects the blood from the donor.

Collection date and expiry date are also marked on the bag. The technician also enters the bleeding details in the donor form.

- Serial no
- Unit no
- Hb%
- Blood group (ABO, Rh)
- Type: PRC/PC/FFP
- Volume & date of collection
- Expiry date (PRC -35/42 days, PC 5 days, FFP-1 year from date of collection)
- 2. The technician also takes a blood sample for testing purpose, in a vacutainer. Following test results are entered:
 - Irregular Antibodies: Present/Nil
 - HBsAG (Hepatitis B): Positive/Negative
 - VDRL (Syphilis): Reactive/Non-reactive
 - HCV (Hepatitis C): Positive/Negative
 - HIV: Positive/Negative
 - MP (Malaria): Positive/Negative
- 3. The bags will be stacked for the component separation procedure. The collected blood sample for testing also will be stacked for batch testing.
- 4. After completion of the component separation process, it is centrifuged and separated into 3 different components:
 - Packed Red Blood Cells (PRC)
 - Packed Cells (PC)
 - Fresh Frozen Plasma (FFP).
- 5. The RFID tag will be then attached to all blood components. On attaining test results, each bag's details (test results, RFID details, expiry date) will be entered into the web portal. The expiry date will be generated in the system and the technician can mark this in the bag. For the expiry calculation, the system checks whether the SAGM (Saline Adenine Glucose Mannitol) bag is added then it can be stored for 42 days. If the SAGM bag is damaged/not added during separation, then the bag can only be stored for 35 days.
- 6. Only PRC is tagged with RFID and the rest of the blood components are traceable in the system using the unique ID. Thus, an RFID ID refers to the following:
 - Serial no (hence, all donor information this will be accessible to only to a medical officer and is displayed in a separate table)
 - Date
 - Serial no
 - Mobile number (used as a unique id)

- Donor name
- Address
- Age
- Sex
- Weight
- Fit/not fit
- Donor nature (frequent, ..)
- Other details
- Unit no (hence all blood-related information)
- Hb%
- Blood group (ABO, Rh)
- Type: PRC (packed red cell),
- Volume
- Date of collection
- Expiry date
- Date/time of tagging
- 7. FFP and PC will be stored in respective storage refrigerators. PRC will be stored in the refrigerator marked Unreserved. Before storing the bag to the refrigerator, it needs to be scanned in through the IoT device mounted on each refrigerator. The status of bag will be displayed on the device screen.
- 8. The medical officer or the chief technician has to review and accept the bags. Then these blood bags would be counted into the current inventory.
- 9. Blood bags should be stored in the refrigerator and inventory details will have to be updated in the software. Temperature monitoring and expiry date tracking should be available on the dashboard of the web portal.
- 10. When a patient request is initiated, a blood requisition form along with a blood sample from the patient should be collected and these details are to be entered into the software. An Issue ID should be assigned to the blood sample.
- 11. The software should suggest the location and preferred bags based on the first in first out strategy. The technicians can accept the suggestion or avoid the suggestion based on the current practice of issuing blood bags.
- 12. The technicians will take the bag after scanning out the bag using IoT device and keep it for cross matching.
- 13. When cross-matching results are compatible, the blood bag is attached with an issue tag and kept in the reserved refrigerator. Issue tag needs to be filled by the staff after cross-checking details in the web, blood bag sticker and blood request form. A transfusion reaction form is printed from the web and this is kept for issue to the nursing station (who will be receiving blood to transfuse to patient. This form will reach back after completion of transfusion along with the RFID tag).
- 14. Billing information should be entered and retrieved from the web portal which can be printed or noted in the slip.

- 15. The issued units are stored in refrigerator and the software provides notifications if the issued units are not taken out from the refrigerator on the pre-assigned issue date. Technicians can revert the units or extend the date of issue based on their information regarding the blood bag.
- 16. When issued blood bag is collected from the blood bank; an issue card is attached to the blood bag (maintained in the medical records of the patient at nursing station), a transfusion reaction form, and instruction to remove and return RFID to blood bank after completion of transfusion is given.
- 17. Once the RFID card and transfusion reaction form are returned, the technician has to update the status in the web portal and archive the RFID tag. From this point onwards that RFID can be assigned to new bags after cleaning the surface.
- 18. All details regarding the lifecycle of a blood bag are now available in the software.

4.1.3 IoT devices

After tagging the blood bags with RFID card the blood bag details will be reviewed and accepted at NODE 2. Once the blood bag is accepted, the blood bag is taken to the Blood Bag refrigerator.

The following IoT devices will have to implemented for temperature monitoring and tracking:

- 1. Tracker device
- 2. Temperature sensor

The following steps are followed afterwards.

- Each Refrigerator is provided with an embedded system, a Static Blood Bag Tracker Unit or Tracker Unit.
- Each tagged blood bag is scanned (using the tracker unit) and placed inside the Refrigerator with date-time stamp. Typically, it is moved from primary storage refrigerators to secondary storage refrigerators for shipping to Storage Centres. As the blood bags are taken out, these are scanned out with date-time stamp as well. When the blood bag is inside the refrigerator, it is taken to be at the same temperature as the refrigerator till such time the blood is inside the refrigerator. As the blood bag is scanned out, until it is scanned in, it is taken to be in the room/ambient temperature.

4.2 Data Acquisition automation at fifty-seven Blood storage centers of the state.

As part of the project, fifty-seven blood storage centres are considered as shown in Table 2 below.

| Table 2. List of Approved Blood Storage Centers | | | | | |
|---|----------|------------------------|-------------------|--|--|
| Sl.No | District | Name of Hospitals | Mother Blood Bank | | |
| 1 Alappuzha | | THQH Haripad,Alappuzha | MCH, Wandanam | | |

| 2 | 2 Alappuzha THQH,Cherthala,Alappuzha | | W&C,Alappuzha & Govt.MCH,Alappuz ha | |
|------------------|---------------------------------------|---|---|--|
| 3 | Alappuzha | DH, Mavelikkara, Alappuzha | MCH,Wandanam | |
| 4 | Alappuzha | DH, Chengannur | Govt MCH Alappuzha | |
| 5 | Alappuzha | THQH,Kayamkulam (P K Kunjusahib memmorial TH) | DH,Kollam & MCH Alappuzha | |
| 6 | Ernakulam | THQH Thrippunithura,Ernakulam | RBTC,DH, Aluva | |
| 7 | Ernakulam | THQH Muvattupuzha, Ernakulam | DH,Aluva | |
| 8 | Ernakulam | THQH N. Paravur, Ernakulam | RBTC Aluva | |
| 9 | Ernakulam | THQH,Kothamangalam,Ernakulam | DH,aluva | |
| 10 | Ernakulam | THQH,Perumbavur,Ernakulam | DH,aluva | |
| 11 | Ernakulam | W&C Hospital, Mattancherry | RBTC Aluva | |
| 12 | Idukki | THQH Thodupuzha,Idukki | IMA, Ernakulam | |
| 13 | Idukki | THQH, Nedumkandam, Idukki | MCH, Wandanam | |
| 14 | Kannur | THQH, Thaliparambu, Kannur | DH,Kannur | |
| 15 | Kannur | THQH,Peravur,Kannur | GH, Thalassery | |
| 16 | Kannur | THQH, Payyanur, Kannur | DH,Kannur | |
| 17 | Kannur | CHC,Panoor,Kannur | THQH,Aluva | |
| 18 | Kannur | W&C Hospital, Mangattuparambu, Kannur | DH,Kannur | |
| 19 | Kannur | THQH,Kuthuparambu,Kannur | GH, Thalassery | |
| 20 | Kasargod | Taluk Hospital,Thrikkaripur,Kasaragod | DH,Kanhangad | |
| 21 | Kasargod | THQH, Neeleswaram | DH,Kanhangad | |
| 22 | Kozhikode | THQH, Koilandy,Kozhikode | W&C Hospital Kozhikode | |
| 23 | Kozhikode | THQH,Vadakara,Kozhikode | Beach Hospital,Calicut | |
| 24 | Kozhikode | THQH, Thamarassery | W&C Hospital,Calicut | |
| 25 | Kozhikode | THQH,Kuttiadi,Kozhikode | W&C Kozhikode | |
| 26 | Kollam | THQH,Karunagappally,Kollam | DH,Kollam | |
| 27 | Kollam | Taluk Hospital,Kadakkal,Kollam | DH,Kollam | |
| 28 | Kollam | THQH,Nedungolam | DH,Kollam | |
| 29 | Kollam | THQH, Sastham cotta | DH,Kollam | |
| 30 | Kottayam | THQH Kanjirapally,Kottayam | DH,Kottayam | |
| 31 | 31 Kottayam GH Changanassery,Kottayam | | GH, Kottayam | |
| 32 | 32 Kottayam THQH Vaikom,Kottayam | | DH, Kottayam | |
| 33 | 33 Kottayam GH Pala,Kottayam | | DH,Kottayam & MCH Kottayam | |
| 34 | Kottayam | Govt MCH Kottayam | MCH,Kottayam | |
| 35 Malappuram TH | | THQH Tirurangadi, Malappuram | Dh,Tirur & | |

| | | | DH,Perinthalmanna |
|---------------|--------------------------|--------------------------------------|--|
| 36 | Malappuram | THQH, Nilambur, Malappuram | Govt MCH Manjeri & DH Perinthalmanna |
| 37 | Malappuram | THQH,Ponnani,Malappuram | Govt DH,Perinthalmanna |
| 38 | Malappuram | TH, Kuttipuram, Malappuram | THQH,Perinthalman na |
| 39 | Malappuram | THQH,Kottapady Malappuram | MCH, Manjeri |
| 40 | Pathanamthitt a | GH Adoor,Pathanamthitta | GH, Pathanamthitta |
| 41 | Pathanamthitt a | District Hospital, Kozhenchery | GH, Pathanamthitta |
| 42 | Pathanamthitt a | M C C M THQH Ranni,Pathanamthitta | GH, Pathanamthitta |
| 43 | Palakkad | GH Mannarkad,Palakkad | DH,Palakkad |
| 44 | Palakkad | GTSH, Kottathara, Palakkad | DH,Palakkad |
| 45 | Palakkad THQH,Ottappalam | | DH,Palakkad |
| 46 | Palakkad THQH,Alathur | | DH,Palakkad |
| 47 | Thiruvanantha | Dist Model Hospital | GH,tvpm & W&C |
| | puram | Peroorkada, Trivandrum | Hospital, Thycaud |
| 48 | Thiruvanantha | THQH, Parassala, Thiruvanan thapura | GH,Tvpm & W&C |
| | puram | m TUOL Nadura and Thim reported | thycaud |
| 49 | nuram | nuram | ram |
| 50 | Thrissur | THOH Irinjalakkuda Thrissur | DH Thrissur |
| 51 | Thrissur | THOH Wadakkanchery Thrissur | GH Thrissur |
| 51 Thrissur T | | THOH Chavakkad | DH thrissur |
| 52 | Thrissur | | |
| | | | |
| 54 | Thrissur | THQH, Chalakkudy | Blood Bank.thrissur |
| 55 | Thrissur | THQH, Kunnamkulam | GH,thrissur |
| 56 | Wayanadu | THQH Kalpetta,Wayanadu | THQH, Sulthanbatherv |
| 57 | Wayanadu | CHC, Meenangadi | THQH, Sulthanbathery |

Table 2:List of Approved Blood Storage Centers

Architecture of the system at the Blood storage centre is illustrated in Figure 2.



Figure 2:Storage Centre Architecture

As per the architecture given in Figure 5; the process, data collection, and report generation in the Management Information Systems are detailed below:

4.2.1 At Node 1:

- 1. In case of BSC, bulk request for blood can be made in the software.
- 2. BSC will take a printout of the request form generated and give to the blood bank for processing.
- 3. Blood bank enters the details in the software and then issue blood bags as per the availability.
- 4. Blood bags are scanned out from the refrigerator, cross-checked with the printed form and scanned into BSC's transportation container/ice box.
- 5. Upon reaching the BSC, the blood bags are scanned out from the ice box and scanned in through the IoT device mounted on the refrigerator. The stored and collected details are re-verified automatically in the software and then updated.
- 6. At BSC they will repeat the steps from step number 10 to step number 17 in Section 4.1.2.
- 7. BSC will get alerts 15 days before the expiry of PRC and 1 month before the expiry of FFP to return to mother blood bank if it is unused in the BSC. The alert will stay and BSC can initiate the return process through the software. If blood bags are damaged at the BSC they can either return it to mother blood bank for discard option or discard at their facility.
- 8. If any blood bag is damaged, the details will be coming to discard list and the medical officer has the authority to revert this after providing justification in the system.

9. On expiry of a blood bag, the discard list will be automatically updated with the same. Technicians have to approve and remove the blood bag from the refrigerator for discarding process.

4.3 Mobile Blood Bag Temperature Trackers

The blood bags are transported from Collection centre to the storage centre in iceboxes that are fixed with Mobile Blood Bag Tracker Unit or Mobile Tracker Unit. The tracker units shall be compatible with the Mobile Blood Bag Tracker unit represented in the figure below. A photo of the transportation device to which the tracker unit shall be installed is given in Figure 5.



Figure 3: Transportation box to install tracker unit

The process flow at the storage centre is detailed below:

- As the mobile tracker units reach the Storage centre, the device communicates the stored data (every minute's temperature data and the RFID no.s) through the wireless LAN to the Central Server.
- As the blood bags are taken out of the icebox, these are scanned out and the server is notified. Then the blood bags are scanned into the Storage Centre Refrigerator using tracker units. These static tracker units communicate the RFIDs of blood bags stored in them whenever required.

Thus the mobile temperature tracker ensures that the blood bag temperature is accurately recorded even during transit from collection center to storage centre.

4.4 Centralized Application running at State Data Centre 4.4.1 Reports

Various registers are to be generated during donations and blood issues. The following are the registers generated at each blood collection centre wise and consolidated as well by the central application:

- a. Master Register
- b. Screening Register
- c. Issue Register
- d. Donor Register

- e. Component Register
- f. Cross Match Register
- g. Cash Book
- h. Daily Blood Stock Register
- i. Component Discard Register
- j. Weekly Report
- k. Monthly Report
- I. Annual Report

Various reports generated each Blood Storage Centre wise as follows:

- 1. Screening Register
- 2. Issue Register
- 3. Cross Match Register
- 4. Cash Book
- 5. Blood Stock Register
- 6. Component Discard Register

Centralized application can also present consolidated MIS for all blood centres as a dashboard, trends and alerts to state health administrators.

4.5 Develop an interaction portal

As part of the project it is proposed to develop citizen interaction portal connecting all blood collection centres and storage centres across the state to publish blood availability to citizens and collect citizen requirements safely, transparently. This promotes safe, voluntary blood donation. The project envisages to interface with blood donor apps as well as private blood banks so that availability/requirement of blood can be published to needy citizens. Fig 6 below depicts overall architecture.

5 Implementation Strategy

5.1Deliverables

The following list shows the major activities to be carried out at each Blood Collection Centres (BSS's) and Blood Storage Centres (BSC's).

| SL NO | ACTIVITIES |
|----------|---|
| 1 | Develop a web-based application running in the Central Server at State Data Centre to support the following |
| 1.1 | Application to capture DONOR info & print out at Node 1 in Collection Centre |
| 1.2 | Application to capture Blood UNIT details including RFID reader at Node 2 in the collection centre |
| 1.3 | Communication with 4 static tracker units in the collection centre and 2 Static tracker units in 1 Storage Centre |
| 1.4 | Communication with 1 mobile tracker unit |
| 1.5 | Web Application running on the tablet in 1 Storage units |
| 1.6 | MIS reports at a Collection centre (to replace existing manual registers) |

| 1.7 | MIS reports at Storage centre (to replace existing manual registers) |
|-----|---|
| 2 | Hardware system design, supply, installation & maintenance |
| 2.1 | Static tracker units in the collection centre |
| 2.2 | Mobile tracker units in the collection centre and 2 Static tracker units in 1 Storage Centre |
| 3 | Hardware system integration |
| 3.1 | PC nodes(at Collection centre) |
| 3.2 | Tablet (at Storage Centre) |
| 3.3 | Printer (At storage Centre) |
| 3.4 | Wireless router (At Storage Centre) |
| 3.5 | wireless router at the collection centre |
| 3.6 | Central server at Data Centre |
| 3.7 | Printer & RFID reader at the Collection centre |

Table 3: Deliverables

The following systems (hardware and software) shall be delivered as part of the project. The technology partner should specify the architecture in detail explaining the number of devices required at each centre.

- 1. Data Acquisition System at forty-one Blood Collection Centers of the State
- 2. Data Acquisition System at fifty-seven Blood storage centers of the state.
- 3. Mobile Blood Bag Temperature Trackers
- 4. Centralized Application running at State data Centre.
- 5. Citizen interaction portal interfacing with Voluntary donor apps, private hospital blood banks etc to publish blood availability to citizens and collect citizen requirements safely, transparently, promoting safe, voluntary blood donation.

5.2 Project Schedule

The project implementation at forty-one Blood Collection Centers and fifty-seven Blood storage centers of the State should be completed within 8 months.

6. Financials

6.1Cost Estimate Summary

(Provide a summary of the cost estimated to carry out the agreed upon deliverables and related activities, in the below tabular form)

| SI No | Particular | Quantity | Unit | Unit Rate (Rs.) | Total Cost (Rs.) |
|----------|---------------|----------|------|-----------------------|---------------------|
| 1 | Hardware | | | | |
| 1.1 | | | | | |
| 1.2 | | | | | |
| 2 | Software | | | | |
| 2.1 | | | | | |
| 2.2 | | | | | |
| 3 | Manpower | | | | |
| 3.1 | | | | | |
| 3.2 | | | | | |
| 4 | Miscellaneous | | | | |
| 4.1 | Travel | | | | |
| 4.2 | Accommodation | | | | |
| 4.3 | Contingencies | | | | |

| 5 | TOTAL COST (without GST) | | | | |
|---------------------|--|--|--|--|--|
| | | | | | |
| 6 | GST | | | | |
| 7 | TOTAL COST (with GST) | | | | |
| 8 | Warranty (For One year after Pilot implementation) | | | | |
| | | | | | |
| 9 | AMC (without GST) | | | | |
| | | | | | |
| 10 | GST | | | | |
| 11 | TOTAL AMC COST (with GST) | | | | |
| 12 | Payment Terms | | | | |
| 12.1 | Advance | | | | |
| 12.2 | Supply of Hardware | | | | |
| 12.3 | Successful completion & acceptance | | | | |
| Table 4: Financials | | | | | |

* PC+ keyboard/ Mouse/Tab/Broadband Dongle /Servers etc

** Any Software License / OS Platform License/ Mobile App/ Other related Software/Cloud Hosting, etc

***Installation and Commissioning – End to End including Internet, power supply, mounting, Travel etc if any

6.2 Commercial Terms of the Payment

(List down all the payment terms applicable for your organization)

6.3 Service Level Agreement Terms

a) During implementation period

During the implementation, the Technology Partner shall meet all conditions set forth in the Agreement and follow the implementation schedule strictly, failure to comply with the same, shall attract application of penalty clause.

- b) During Warranty period
- i. Software
- As part of the warranty covered as part of the agreement, the Technology partner shall.
- 1) Provide and install, at Technology partner's sole expense, with bug fixes and code corrections to correct software malfunctions in order to bring the services into substantial conformity with the specifications set forth in the scope of work (Schedule A). Bug fixes shall be acknowledged within one hour of the client intimating them and fixed within reasonable time as agreed with the client as per the severity of the bug.
- 2) Provide and install relevant updates of the software released by the Technology partner within the warranty period, installing them within 48 hours of release, without causing any downtime. In the event the Technology Partner foresees downtime requirement, the same shall be carried out with permission of the client
- 3) Ensure that the database used in the Project will be managed with reasonable care and diligence, and that any updates or modifications to the database and related changes to application will be performed in a timely manner, without causing any downtime. In the event the Technology Partner foresees downtime requirement, the same shall be carried out with permission of the client.
- 4) Perform any updates or modifications related to changes in configuration (App server/Web server, DB server etc)/ operating system (OS)/ other operating environment of virtual machine's hosted at SDC in a timely manner, without causing any downtime. In the event the Technology Partner foresees downtime requirement, the same shall be carried out with permission of the client.
- 5) Take necessary steps for maintaining SSL Certification and Domain validation and maintenance, including the initial purchase and any subsequent renewal during the Warranty Period.

- 6) The Technology Partner shall provide timely and adequate support to the Client whenever necessary, including technical support and customer service. Such support shall be provided within 12 hrs from the receipt of the support request from the Client.
- 7) The Technology Partner is responsible for implementing security measures to protect the application from unauthorized access and promptly addressing any security issues within 12 hours of identification.
- 8) The Technology Partner must provide monthly reports to the Client that outline the application's performance, availability, and incidents that occurred during the reporting period.
- 9) The Technology Partner is responsible for 24/7 monitoring of the application, proactively detecting and resolving any issues within 24 hours of detection.
- 10) The Technology Partner is responsible for providing training and documentation to the Client's staff on the proper use of the application, which must be provided after before handing over the project to the End User Department
- 11) The Technology Partner must maintain adequate staffing levels to provide timely and effective support for the application and provide a designated point of contact for the Client's staff to contact in the event of any issues.
- 12) All issues raised during the warranty period must be addressed and resolved by the Technology Partner.
- ii. Hardware
 - The Technology Partner shall ensure that any hardware components supplied as part of the project will be free from defects in materials and workmanship. If any such defects arise during this warranty period, the Technology Partner will repair or replace the defective hardware at no additional cost to the Client.
 - 2) The Technology Partner shall ensure that
 - a. The hardware will meet the performance specifications specified in the Agreement throughout the warranty period
 - b. Periodic maintenance of the hardware is carried out as required.
 - c. If any issues arise due to the Technology Partner's improper actions or omissions, the Technology Partner shall promptly correct the issues at no additional cost to the Client
 - 3) The Technology Partner is responsible for providing training and documentation to the Client's staff whenever Hardware/ Equipment is repaired/upgraded during warranty period. The Technology Partner must maintain adequate staffing levels to provide timely and

effective support for the Hardware/Equipment, and provide a designated point of contact for the Client's staff to contact in the event of any issues.

- c) During AMC period
- The Technology Partner shall comply with all the conditions in the AMC Agreement to be signed upon mutual agreement.

6.4 Project Monitoring and Feedback Collection

- a) The Technology Partner shall monitor and track the progress, milestones, and overall performance of the project. The project monitoring should include regular status meetings, progress reports, and key performance indicators (KPIs) to assess project success.
- b) The Technology Partner shall provide regular project status reports to the client, outlining the achieved milestones, deliverables, and any significant project updates. The frequency and format of the reports shall be defined and agreed upon by the client.
- c) The Technology Partner shall take necessary actions for collecting feedback from the client & end user department regarding the project's progress, quality, and adherence to requirements. Feedback collection methods may include surveys, meetings, or other communication channels to gather input from client & end user department.
- d) The Technology Partner shall review and analyze the feedback received from the client and end user department promptly. Based on the feedback, the Technology Partner shall develop an action plan to address any identified issues, concerns, or areas for improvement.
- e) The Technology Partner shall document the lessons learned from the project monitoring and feedback collection process.