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ANG: A CROSS-PLATFORM MOBIL APPLICATION TO MONITOR THE AVAILABILITY OF HUMAN ORGANS FOR TRANSPLANTATION AT HOSPITALS IN REAL-TIME

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ABSTRACT

Organ donation is the process when a person sanctions an organ of their own to be abstracted and transplanted to another person, licitly, either by consent while the donor is alive or departed with the assent of the next of kin. Organs and tissue that can be donated include heart, kidneys, lungs, pancreas, liver, intestines, corneas, skin, tendons, bone, nerve and heart valves. [1] Organ donation can only be considered after brain death has been declared by a physician. Here, we put forth a cross-platform mobile application named 'Ang' (: Organ in Hindi) which will allow hospitals in real-time to update and monitor the information on possible organ harvest cases from a recently deceased human body or a brain dead person.

Keywords— **Real-time, cross-platform, Organ donation, Transplantation, Hospital, Patient, Microservices, Cloud, Donor**

I. INTRODUCTION

Organ donation is a prime area of focus in the present-day world. A revolutionary app to help ease the process of organ donation is of paramount importance; this nifty functionality is in the works to be implemented as an add-on feature to our existing healthcare app - MediDocs.

India is home to 20% of the world's visually impaired. Nearly 40 million people in India, including 1.6 million children, are blind or visually impaired due to uncorrected refractive error.[2] 26,789 deaths occur each day, and if all the people who die donate their eyes, there will be no blinds in India within 4 years.

[3] The Impact of organ donation has a far deeper reach and benefits for various people, like for the fact that one donor can impact eight lives: That's right, one single organ and tissue donor can save or ameliorate the lives of more than eight people, helping to restore eyesight, damaged tissues or vital functions.

Each organ has its own limited preservation time after the death of a person. The following are the preservation time for various organs.[4] The timeframe are as follows: Kidney: 24-48 hours, Liver: 12-16 hours, Lungs: 4-6 hours, Intestines: 4-6 hours, Heart: 4-6 hours, Cornea: 48 hours

Most of the time, the preservation time limit exceeds when the close relatives arrive and gives the consent to donate organs from the deceased person. *Ang* provides a platform for people who are willing to sign up for organ donation before or after their death. Furthermore, the app helps patients who require organ transplantation to request for it in the platform by providing the necessary credentials. Moreover, it is challenging to communicate the availability of organs at a particular hospital ready for transplantation with other hospitals and matching

patients waiting to accept organs within the stipulated time.

The proffered system assists hospitals as well as individuals in real-time to get the details of currently available organs ready for transplantation at various hospitals across the country along with the remaining time for the organs to remain healthy. The robust location tagging feature which we are introducing also helps in tracking the harvested organ's live location if it has to be transported to the recipient patient's hospital via road.

We believe that the app will have a better reach because the real-time donation feature of the app tends to be more convincing to the common public as well as it deems to be a humanitarian cause. With this paper, we will be explaining about a capable build which helps organ donation in real-time scenarios.

II. Related Works

In the paper _Transplantation Scenario in India Today', the author S Vasudevan[5] explains about the current scenario of Indian organ transplantation, it talks about the setting up of the Indian Transplant Registry, transplant-related data from different accumulated and collated to derive information regarding the number of transplants done in the country, essential demographic data of Indian patients undergoing transplant, the immunosuppressive regimen used in various centres, the short term and long term results of the allograft, complications during the management in the short term and long term, patient survival after transplants, the healthcare profile of Indian patients, numbers of living and cadaver transplants, relationship in case of related transplants, and profile of donors, Figures being mentioned are 1,50,000 patients waiting for renal transplantation while only 5000 get timely renal transplantation done. Nearly 1,00,000 patients reach end-stage liver disease, and a much lower number get timely liver transplantation.

The online part of the organ donation first came to effect as Dr Sunil Shroff a urologist based in Chennai led the organization which produced a Tamil Nadu model for organ sharing based on transparent seniority-based online recipient registry. [6]

Later this was replicated in Kerala utilizing the platform created by the Kerala Network for Organ Sharing also called Mrithasanjeevani. In nearly years of its existence, it has been going strong each year. [5,6]

But even with these registries and various initiatives by the government none of these tends to provide the donor list in real-time, and there is no specified app which helps people in donating organs, This is where our cross-platform application come into play, such an app will have a positive impact in the society as more and more people will be able to donate their organs with a touch of their smartphone, this would likely increase the chances of many people to survive who die every day without being able to match a donor, An application such as this would make all of this possible.

III. Proposed Method

The main function of the specified feature of the app is depicted below as the principal design of the app.

Cloud Computing Infrastructure **-** Cloud computing is one of the potential and robust solutions to provide dynamically scalable and also virtualized resources as a service with a pay-as-you-go manner [7].

By pooling the various life care IT resources into clouds, mHealth solutions can reduce the cost and increase utilization as the resources are delivered only when they are required. For instance: Amazon S3, Microsoft Windows Azure, OpenStack and Rackspace are the few names. We utilized cloud computing as Infrastructure as a Service (IaaS) to provide processing power and storage space for our proposed organ donation application. Each user's information is stored and retrieved when it is required to broadcast the blood donation message to all the volunteer donors. Web services are the communication bridges between the donor and requester via cloud server. The identification of the roles is based on user IDs registration for distinguishing the users and corresponding response. Web services contain register user, authenticate user, broadcast alert messages, and update response functions which are called by our smartphone application to make the timely access of the information.[8]

Organ donation & request portal - Where people willing to donate organs before and after death can sign-up (Like Mrithasanjeevani). Patients seeking organs for transplantation can also request the same in this portal by providing valid documents and proof of the urgency of the organ by their doctor.

Hospital portal - for reporting availability of organs ready for transplantation, Once a patient is declared dead or brain dead by a physician, the hospital can look-up on the MediDocs server using his fingerprint linked to his MediDocs ID whether he has already signed up for organ donation after death. If he has, then the hospital independently takes the decision to donate the person's organs without waiting for the relatives' consent which could delay the procedures and lifespan of organs for successful harvesting and transplanting. The information of organs is then uploaded to the server through the hospital's portal. If the deceased person or brain dead patient has not signed up for organ donation, consent is to be taken from the close kin.

Organ availability notifier - It is to where hospitals provide facilities for organ transplantation and patients, sorted according to priority are notified of the available organs at hospitals based on location.

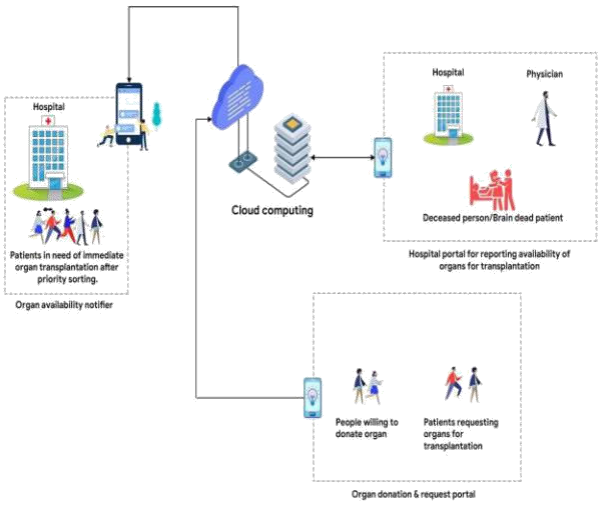

Fig 1. Architectural design of *Ang* module

Figure 1 illustrates the architectural design which inturn showcases the overall idea of the project which we are going to implement, there are lots of other factors which come into play while considering the overall idea of the project, these will be discussed in the coming sections. The three portals combined make up the primary function of the app, whenever a patient dies, if registered with the app, his organs can be harvested by hospitals and notify the other hospitals via the app, specifying the availability of organs ready for transplantation. The priority in which who should get the organs first can be sorted via cloud computing where the life-threatening situation of the individual as well as priority for children are considered.

IV. Software Implementation

For Infrastructure and Storage, We currently use Schemaless (built in-house on top of MySQL), Riak[9], and Cassandra[10]. Schemaless is for long-term data storage; Riak and Cassandra meet high-availability, low-latency demands. Gradually, Schemaless instances supersede individual MySQL and Postgres instances, and Cassandra supersedes Riak for speed and performance. For distributed storage and analytics for involute data, we utilize a Hadoop [12] warehouse.

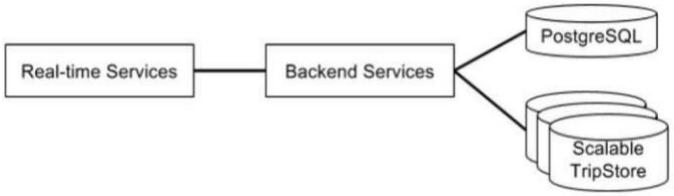

Fig 2. Overview of backend services

For logging, we use multiple Kafka [11] clusters, and the data which is archived into Hadoop and/or a file storage web service prior to its expiration from Kafka. For app provisioning, We use Docker containers on Mesos[13] to run our microservices with consistent configurations scalably, with help from Aurora[14] for long-running services and cron jobs.

For Routing and Service Discovery, Services should be able to communicate with each other in our complex network. We've used a mix of HAProxy and Hyperbahn to solve this problem. While Developing and deploying, We combined Packer, Vagrant, Boto, and Unison to create tools for building, managing, and developing on the virtual machines. We utilize Clusto for inventory management in development. Puppet manages system configuration.

At the lower levels, we primarily wrote in Python, Node.js, Go, and Java. We adopted Go and Java for high performance reasons. We provide first-class support for these languages. Java capitalizes on the open source ecosystem and integrates with external technologies, like Hadoop and other analytics implements. Go gives us efficiency, simplicity, and runtime celerity.

V. Presentation Model

The presentation model deals with the specification of visual forms of UI objects and their layout as a whole.

A UI is generally presented within a rectangle area of the screen. Therefore, a UI is considered as a Presentation Object that is presented in a Presentation Space, To establish a presentation model of a complex UI with multiple constituents, space needs to be divided into smaller rectangle areas to accommodate particular presentation objects. In this way, a presentation model of UI is superficially composed of multiple smaller presentation spaces and a set of presentation objects.

Fig 3. Position of Ang module in MediDocs app dashboard

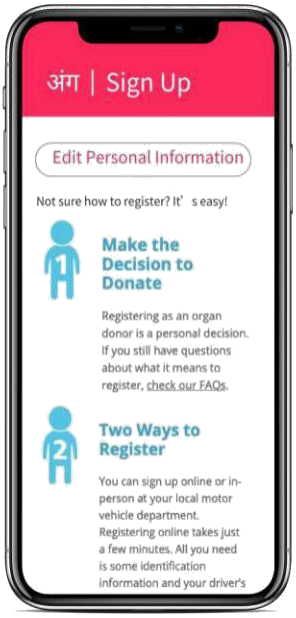

Fig 4. Layout of organ donation sign-up portal

Figure 3 shows the first interface of the app, as stated earlier,*Ang* is a feature of our all in one medical oriented app —MediDocs‖. Here, Figure 4 shows the sign-up page where each of the donors who is willing to donate has to sign up following the instructions.

Fig 5. Mapped view of available organs

Fig 6. Detailed view of available organs

Figure 7 shows the profile interface with which the person has just created; the user is able to view the organs which he has made the decision to donate as well. Figure 6 shows the view of the app where they‘re able to see the available organs in the place; this availability of organs can be filtered by the hospitals, as shown in figure 8. The time-limit of the organs available, as well as other details, are made available when clicked on the organ symbol, as shown in Figure 6.

Fig 7. Profile view of user

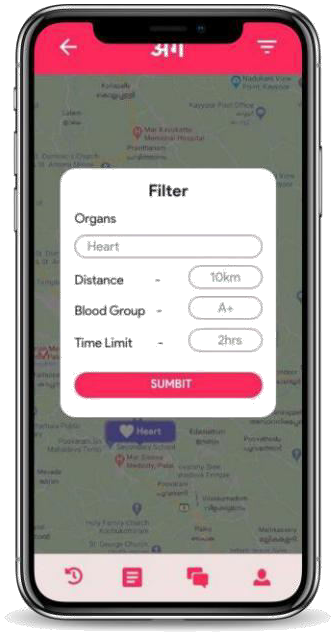

Fig 8. Filter option in map

As shown in figure 8, the UI is the most important of the app as it makes it the user to use the app for efficiently and effectively.

VI. TESTING AND ANALYSIS

We have conducted a study for evaluating the effectiveness of the interface of the app with the help of lookback[15], where 12 people have participated in the study. The test order example screenshots that appeared are as follows:

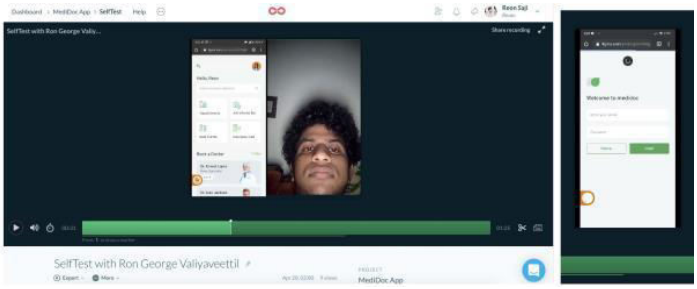

Fig 9. Dashboard interface effectiveness test with prototype

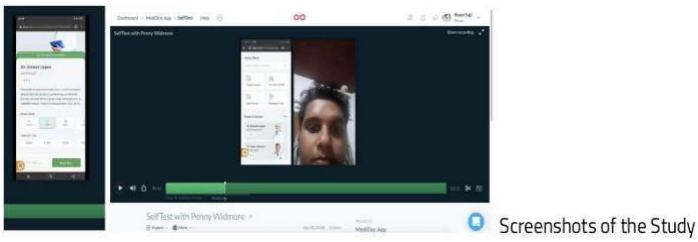

Fig 10. User profile interface effectiveness test with prototype

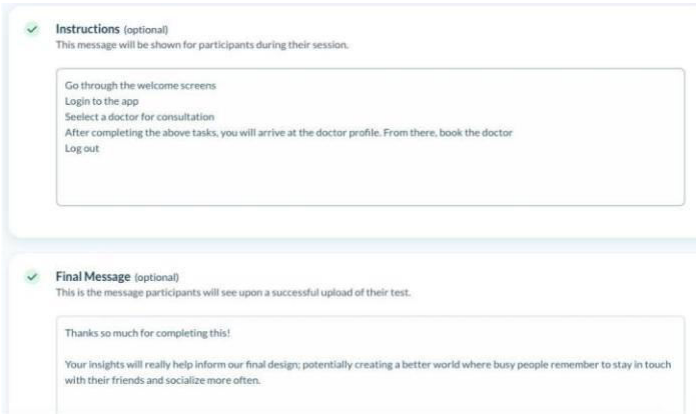

Fig 11. Instruction and acknowledgement messages for testers

The testing was done successfully, and the following results were obtained.

- Most of the users' suggestions were to improve the colour contrast, so we changed the base colour based on the accessibility of design.
- Some people felt a bit confused in the onboarding signup and login button. So we changed the placement of the onboarding button in the new iteration.

VII. CONCLUSION AND FUTURE WORKS

We have finished the complete appmodel for the overall which we intend to develop as a complete product in the near future. Using various geolocation featured apps, we can establish the app with every level through the method above (All figures about the main product in this paper are made models that were created). And, now we have finished the transformation from abstract model to a working prototype with the help of React.

The building of this app‘s environment and research has shown this model of implementation of organ donation is appropriate, feasible, effective, powerful and easily acceptable in complex and is a highly usable UI model.

The future work will be focused on the consummation and applications of the model, the enrichment of the user interface design patterns and the standardization as well as creating an effective backend for the application which stores the data of the users securely. Especially we need to add the formalized description of the operations and the arithmetic logics, so as to achieve the general generating of the finished code.

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