Immediate Blood Convey and Equilibration through Location Base Donor Searching Facility Using GIS


Abstract — Immediate Blood Convey and Equilibration Service (IBCES) is a web solution that corporates with blood transfusion activities for blood conveying and balancing all activities related to blood requests and responses island wide. This web solution mainly proceeds with GIS Location based donor search service to find blood donors according to their geological locations. Emergency SMS service is the other main research area that the project in involved with 50 samples of user information were collected and fed in to the system to test it on the realistic user environment. The service will provide facilities to automate blood transfusion activities that are related to health-care sector in Sri Lanka.

Keywords — Application Programming Interface (API), Geographical Information System (GIS), Global System for Mobile (GSM)

I. INTRODUCTION

Project IBCES mainly provides blood transfusion activities and make them equilibrate for more effective service. It facilitates confidentiality of the blood donor details and corporate and communicate with them for an effective service. Functionalities of this web solution must be clear, user-friendly and very accurate, as it concerns patients or human life.

When analyzing the current procedures of blood transfusion activities in Sri Lanka, the first point of contact is National Blood Transfusion Center in Narahenpita, which is the key point of blood convey activities. This research aims to address all the problems and difficulties associated with the current blood convey activities and find the solutions to eliminate them from this web solution to make it applicable to the given scenarios. In the real time scenarios, Sri Lanka has no such a web solution that facilitate blood convey activities and support health care activities related to the national blood bank. IBCES is the first e-health web solution which covers the following features,

- Hospital Handling Service
- Donor Handling Service
- Emergency SMS Alert Service
- Location Based Donor Search Service
- Android Based Application for users who corporate with the main web system.

A. Hospital handling service

Hospital handling service provides the facility from registration process to controlling each blood bank blood amount levels graphically.

B. Donor handling service

Donor handling service provides the features to its registered donors and communication facilities for immediate blood conveying procedures.

C. Emergency SMS alert service

Emergency SMS alert service provides
- Online SMS alert service (web based), and
- Offline SMS alert service (individual purpose).

D. Location based donor search service

Location based donor search service helps to find hospitals and blood donors from their geographical locations by using Google maps and vector data models.

E. Android based mobile application

This is a separate service provided to specific user levels that are responsible for this blood conveying activities. Using smart mobile devices users can make updates, make requests and check notifications when the emergency situations occur.

II. METHODOLOGY

IBCES is mainly focused on location based service through GIS and SMS application.
A. Emergency SMS alert service

It is mainly divided into 2 categories such as,
- Online SMS alert service (web based)
- Offline SMS alert service (individual purpose)

1) Send SMS alert to all selected suitable donors

SMS alert will be sent by the main system to all suitable blood donors, when there is not enough blood amounts to satisfy the current critical situation. SMS alert helps to trace the donors mobile signal by the service provider and find the nearest signal tower area to locate the donor.

2) Send SMS through NowSMS gateway

The ultimate goal of the Emergency SMS alert service is to generate the SMS [1]s based on given selected criteria, store them on the MySQL database, retrieve them from the database and send to the multiple recipients/blood donors. It is done as follows;

1. Generating SMS with given criteria
   PHP code segment will use POST method with specific hospital that made blood request and specific blood category. Those values will be embedded to the generated SMS content with submission of the form.

2. Save generated SMS in to MySQL database
With the form submission of the generated SMS, it concurrently saves in to the MySQL database with SMS ID, for further usage in send SMS function.

3. Sending SMS to multiple recipients through the SMS gateway
   Using the Gateway code segment, application sends the SMS messages to the multiple donors.

   Each and every step requires full connectivity of MySQL database and open connection with NowSMS gateway.

A. Location Based Donor Search Service

   Another ultimate goal of the Location based search service is to get updated details from the MySQL databases and show the locations with longitude and latitudes on the Google map [3] with Google API [4] to find the locations of the blood donors according to user selection criteria with selected blood group.
   - Search hospitals by location
   - Search donors by selected blood group criteria

   All functions of this component must have active internet connectivity with updated web browser. Using JASON encoding [5] with Google maps and AJAX sources with JavaScript fetch location data (longitudes and latitudes) from MySQL database with the selected criteria. Google API [6] has all inbuilt and predefined methods and functions that are in Google maps.

   Other most important component of the research is location based search service. It collaborates with Google API and Google maps with MySQL databases.

   └ Figure 3 : Emergency SMS Alert Service
   └ Figure 4 : Emergency SMS Alert Service

III. RESULTS AND DISCUSSIONS

   - According to testing and general usage, Emergency SMS service gives 90% of accuracy in selected criteria (hospital and blood group).
   - There are no data input requirements because all criteria are in user friendly selected options (drop-down methods).
   - Miss-typing or missed selections are eliminated.
   - When the selection criterion is correct it will generate SMS and user can view it at the same time.
   - When user selects the needed blood category in blood category option it will display all available blood donor mobile ID/numbers on mobile ID text field.
   - In SMS sending function it will 95% accurately send SMS to each selected blood donor with 2second delay, which means SMS gateway can send 30 SMS per minute from the IBCES.
   - According to the results of the location based service, it works accurately with donor location using longitude and latitude of the registered location on the Google maps.
   - It mainly uses IBCES donor and hospital data collections to track locations.
   - Application uses selection criteria for hospital and blood group.
   - Using longitudes and latitudes [3] with 8 decimal points it will increase the accuracy of location selection process.
   - User can find selected blood donors according to the distance from the requested hospital using geo-fence [4] option with selected distance levels.
Distance calculation equation used in system is
\[
\text{SQRT} \left( \text{POWER} \left( 69.1 \times (V.\text{Platitue} - 6.966894), 2 \right) + \text{POWER} \left( 69.1 \times (79.921834 - V.\text{Plongatitue}) \times \text{COS} \left( \frac{V.\text{Platitue}}{57.3} \right), 2 \right) \right) \text{ AS distance} \quad (1)
\]

- It helps to user to find nearest blood donor for emergency cases. And it makes the results very accurate.

There are already existing technologies that are used in this research. One such is the SMS services via web based applications. One main finding of this component is sending SMSs to multiple recipients via PHP web site using SMS gateway. Another main finding is the location based search component that uses Google API and Google maps. There are legal factors and policies which highly restrict mobile tracing events even for research purposes, because of confidentiality of the mobile users. Those restrictions must be considered when planning for future researches.

IV. CONCLUSION AND FUTURE WORK

Main blood transfusion service acts as an important role in health care field. As a facility, IBCES is concerned with the areas that automates the blood convey activities all over the Sri Lanka.

As a big necessity of health sector for automated blood transportation, refilling blood stocks and finding blood donors immediately in emergency cases, IBCES provides procedures for efficient health care service. However following limitations were also experienced during the research process.

- System is strictly focused on National Blood transfusion center activities and facilitate to its procedures.
- Telecommunication bans and policies that some service providers are following is very restricted on tracking facilities for outside researchers.

- Using GPS technology in Sri Lanka to track exact location with higher accuracy is difficult to achieve. Personal mobile or GPS tracking is very costly even for individual purposes.

Mobile signal tracing is still on research levels in the Sri Lankan telecommunication service field. And it is a restricted area to be used by general public because of its high privacy provided for users. But in future developers can come to agreements with service providers and do further researches on this field.

REFERENCES

[1] NowSMS,
[2] Econym,
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[6] PHP.net,