A Project Report

On

Compatible data processing for DHIS2 platform for AMR surveillance Integration of Rightbiotic platform

BY

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2018B1A30860H

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BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE PILANI (RAJASTHAN)

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I would like to express my gratitude towards BITS Hyderabad and Dr. Suman Kapur for providing me with the opportunity to work on this project and make a difference in the medical field and understand the technical needs of the same. I would like to thank Gitika Arora and the team of HISP India for providing me with guidance on the DHIS2 platform and framework. I would also like to thank Google and Android Studio for providing me with such a great platform and a framework to work on the application. Finally, I would like to express my gratitude to my parents for their continuous support throughout the project.

Thank you all.

Birla Institute of Technology and Science-Pilani,

Hyderabad Campus

Certificate

This is to certify that the project report entitled "**Compatible data processing for DHIS2 platform for AMR surveillance Integration of Rightbiotic platform**" submitted by Mr/Ms. Athul V (ID No. 2018B1A30860H) in fulfillment of the requirements of the course BIO F376, Design project course, embodies the work done by him under my supervision and guidance.

Date:30-04-2021 **(DR. Suman Kapur)**

BITS- Pilani, Hyderabad Campus

ABSTRACT

This project is to integrate AMR Data surveillance of Right Biotic Platform with DHIS2.The machine is used to determine the sensitivity of bacteria towards various antibodies.DHIS2 can be used to centralise the existing platform, so it can be used by various people from around the world.

The update to integration can be done using WebAPI provided by the DHIS2 Platform. The Web API is a component which makes it possible for external systems to access and manipulate data stored in an instance of DHIS2. We can use Web API to grant access to the current existing app to create and modify server data.

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Introduction

This project is to integrate AMR Data surveillance of Right Biotic Platform with DHIS2.The machine is used to determine the sensitivity of bacteria towards various antibodies.DHIS2 can be used to centralise the existing platform, so it can be used by various people from around the world.

The machine called the RightBiotic, analyzes samples inserted into it and gives out a result of the bacterial load, the type of bacteria and the sensitivity to the panel of antibiotics used.

This result is further analysed by the app to give out an simple Resistant, Sensitive and Intermediate Tag to the results.

This result is then printed out in a pdf format.

DHIS2 is a Health Management Information System, developed about 20 years ago to store and manipulate data in the Health Management field.

DHIS2 is an amazing platform as it a) Collect Data b)Process data and turns it into indicators.c) Stores and protects the data and helps in analysis of information in various Ways d)Presents information in reports and dashboard e)Shares information with other systems, e.g, surveillance and tracking

It is stable and well supported.They release a new version every three months. It is resilient, flexible,decentralized.

We intend on making DHIS2 platform as our primary data storage and analysis platform.

DHIS2 can help in Collection of our data and processing.

We intend to connect the existing app and send the data directly to DHIS2 platform for data storage and analysis.

Objectives of the Design Project

The objective of this project was to learn about DHIS2 and the ways in which DHIS2 can assist in AMR surveillance. It also included POST data to the DHIS2 platform from the existing app. To set up a database with the help of HISP India and transfer data to it.

AMR Surveillance

Q.What are Antimicrobials?

A.Are medicines used to treat infections caused by microbes in humans, animals, and plants. They include antibiotics, antiparasitics, and antifungals.

Q.What is Antimicrobial Resistance?

A.When Bacteria, Fungi, Viruses mutate over time and no longer change over time and no longer respond to medicines i.e the antimicrobials. Increasing the risk of disease spread, severe illnesses, and death. And microbes being impossible to treat.

Q.Why is Antimicrobial Resistance a global concern and why do we need to survey it?

A.The emergence of drug-resistant microbes that have acquired new resistance mechanisms. The so-called superbugs that are resistant to multiple drugs are spreading at an alarming rate.

In 2019 WHO identified 32 new antibiotics in clinical development that address the WHO list for priority diseases out of which only six were classified as innovative or as effective against these pathogens.

If people don't change the way they use antibacterial and antiviral drugs are used now. The newly formed antibiotics will reach the same fate as the current ones and become ineffective.

The cost of AMR to national economies and their health systems is significant as it affects the lives of the patients as they stay in hospitals longer and require more expensive care units.

Without tools, for the prevention and treatment of drug-resistant infections, it can soon become a global crisis.

Thus RightBiotic and AMR Surveillance are trying to be the solution for an upcoming problem.

The Right Biotic Machine

The machine comes with hardware for taking readings from different samples.

The reagent enables the user to harvest the bacteria from biological fluids and grow them in the presence and absence of antibiotics. The antibiotics can be chosen by the user. The growth of these bacteria is monitored by calorimetry and nephelometry.

The data obtained is analyzed for reporting the bacterial load, the type of bacteria and the sensitivity to the panel of antibiotics used.

The results obtained are stored in the form of CSV files.The results from the test can help a doctor determine which drugs are likely to be most effective in treating patients. Usually the time taken by a lab to obtain the results is about 3-4 days, but this machine has been able to significantly reduce the time to about 4-5 hours.

As It is possible for bacteria and other pathogens to mutate, antibiotics that work today may or may not work six months from now. Hence, sensitivity tests are extremely important and useful tools.

The machines will hence play a significant role in improving the field.As we can see in the figure to the below, the machine is equipped with a thermal printer which directly prints the csv files in a text format.

Currently, this machine is very bulky and at the same time has a lot of empty space.

Also, in order to transfer the data via LAN, it needs to be connected with a WiFi module externally.

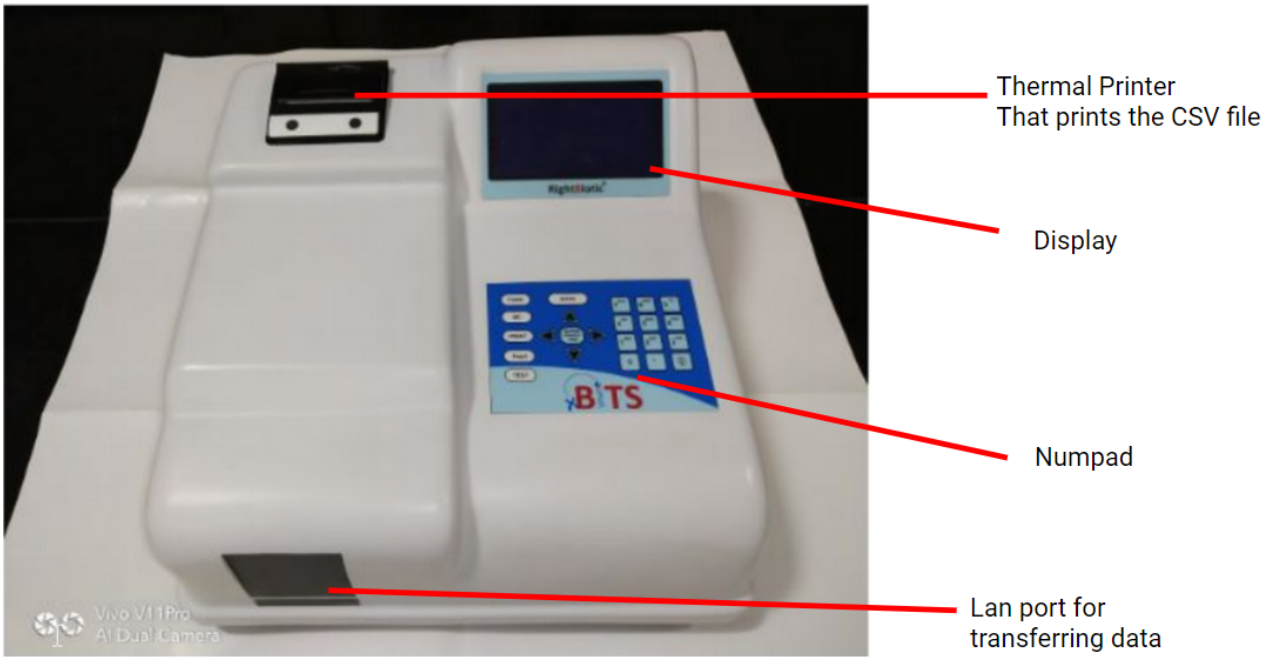

Figure 1: The RightBiotic Machine

The Current App

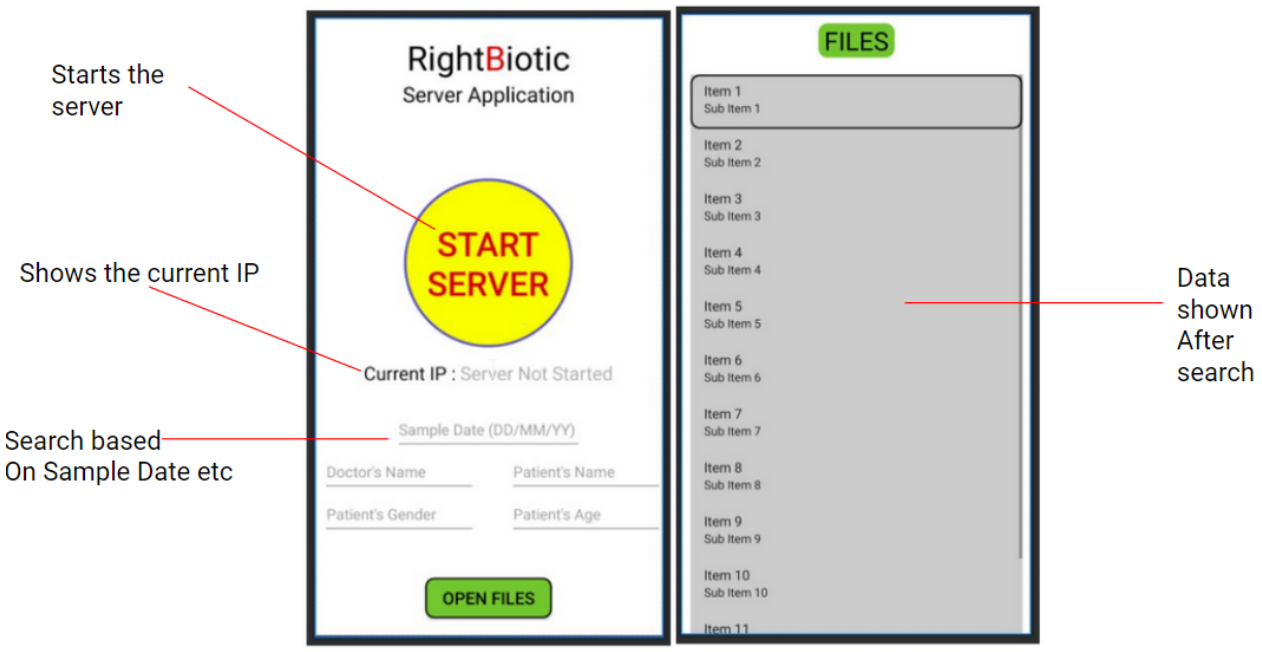

Figure 2: The Current RightBiotic App

The current app has the following affordances:

a) Start an internal server: hosting an internal server by connecting to the local area network
b) Retrieve and process files: It can receive files over the network and then extract the data
c) from them and process it into a labelled file.
d) The open files button: It can be used to open the internal storage where the files are
e) stored with their dates.
f) The files received can also be viewed in the app in a scroll view for easy access.
g) Open files leads to the new
h) Server address indicates the ip address to be entered in the machine
i) The pdf files received and shown on the app are clickable and the filename is the patient id.

The current pdf generated is shown below. It shows Resistance, Sensitive and Intermediate as Lab Results for Antibiotic Name.

Figure 3 : The PDF generated by the RightBiotic App

Reasons for choosing DHIS2

DHIS2 is an open-source program that was developed 20 years ago.

It is stable and well supported.

They release a new version every three months

It is resilient, flexible, decentralized.

It uses a result-based M&E framework.

That is that it starts with the impact or final results and then populated with what is required/ needed in each of the other system components for achieving the final results.

Table -1: Comparison table of different platforms available.

Name	Pros	Con
1.OpenEMR	Electronic Medical Records,fully integrated electronic medical records, practice management for a medical practice, scheduling, and electronic billing	Mostly used for medical purposes and places like hospitals rather than onsite small clinics.
2.OpenMRS:	General-purpose electronic medical record system that could support the full range of medical treatments.	Used for medical treatment logs, our aim was more inclined towards AMR Surveillance
3.DHIS2	It is stable and well supported. Its features full. They release a new version every three months It is resilient, flexible, decentralized.	None mentionable. The program is complex and large for new users to work with.

	It uses a result-based M&E framework. It has been already used by HISP India for AMR surveillance.	

DHIS2

DHIS2 is an application that helps in a) Collect Data b)Process data and turns it into indicators. c) Stores and protects the data and helps in analysis of information in various ways. d)Presents information in reports and dashboard e)Shares information with other systems, e.g, surveillance and tracking.

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Figure-2: Organism group isolation rates - Urine

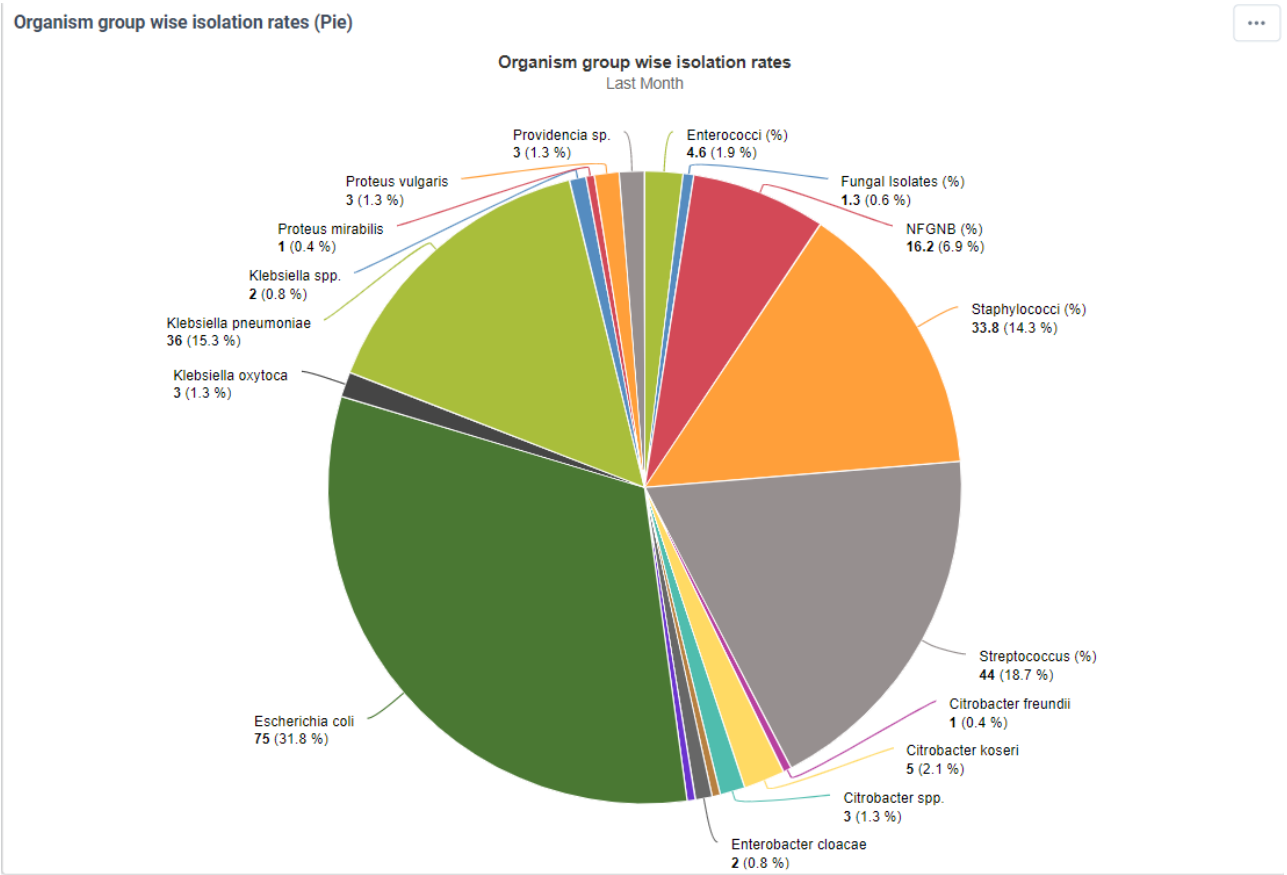


Figure-3: Patient Registration Portal

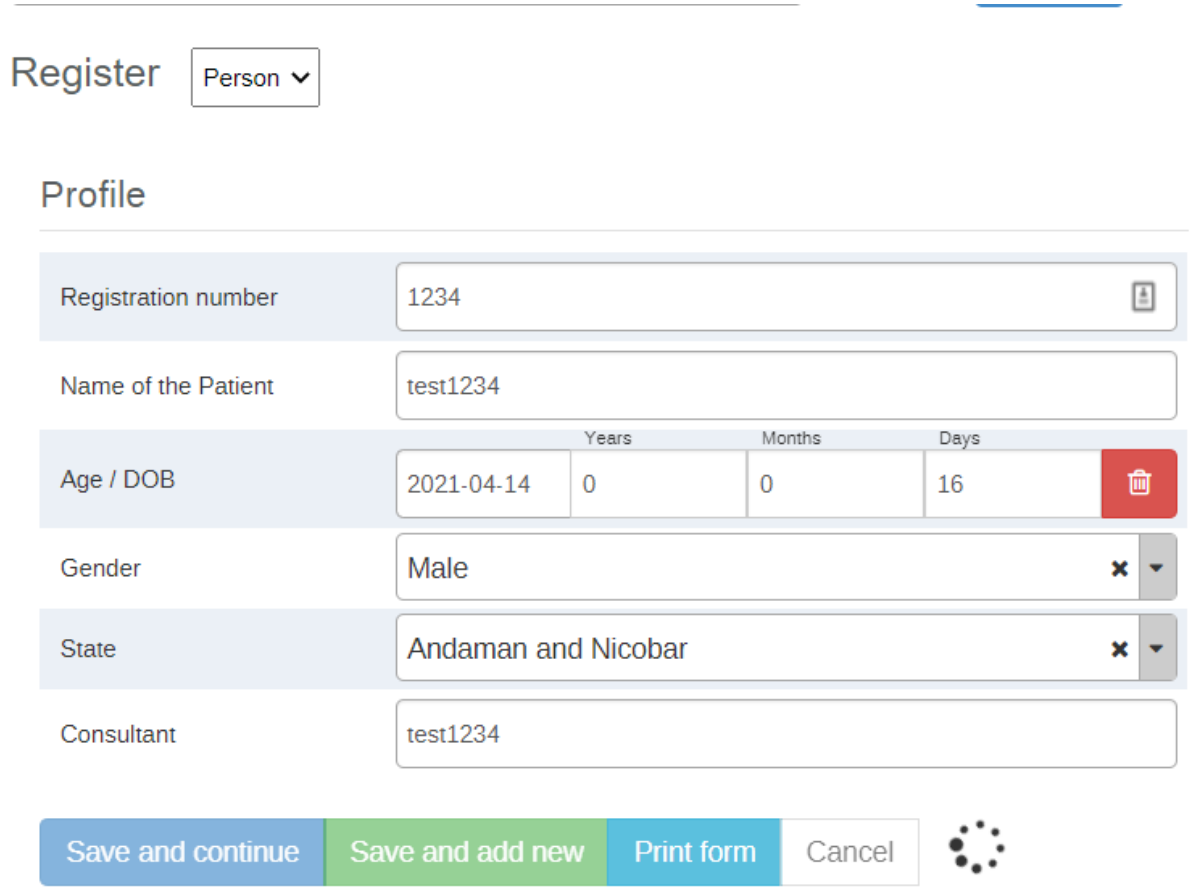


Figure 4 : AMR Surveillance Dashboard

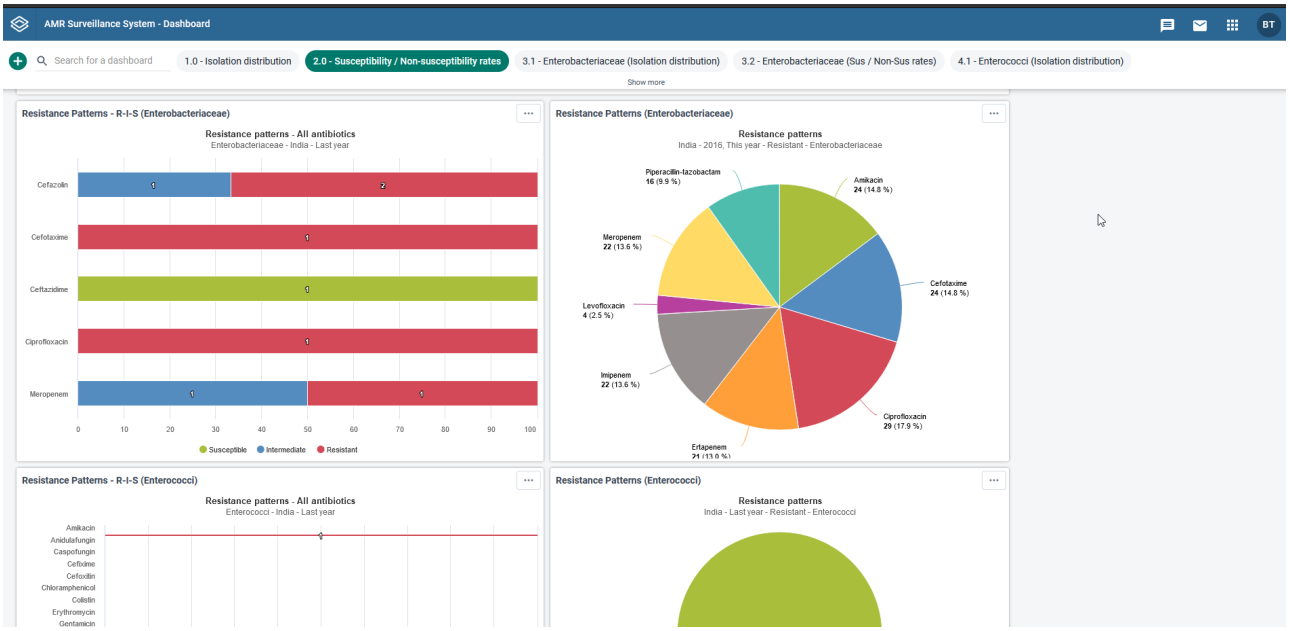


Figure 5 : User Entry

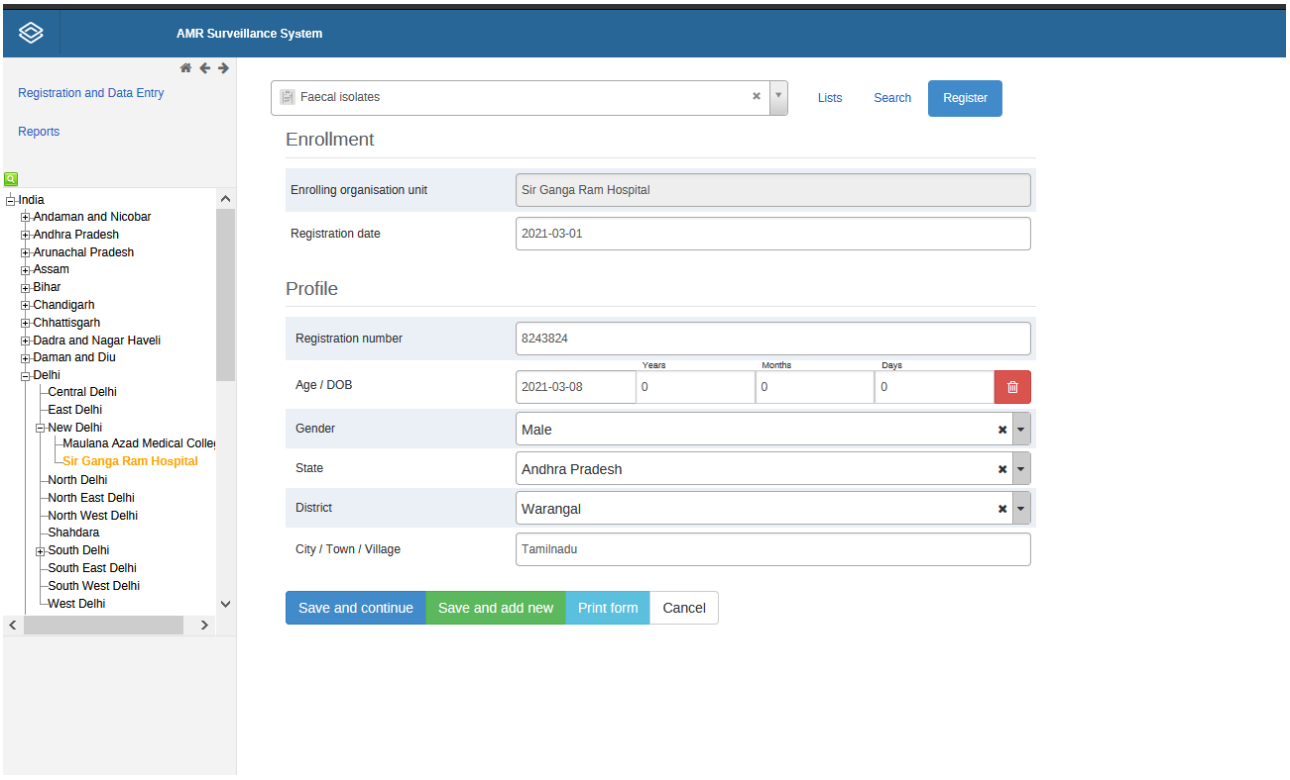
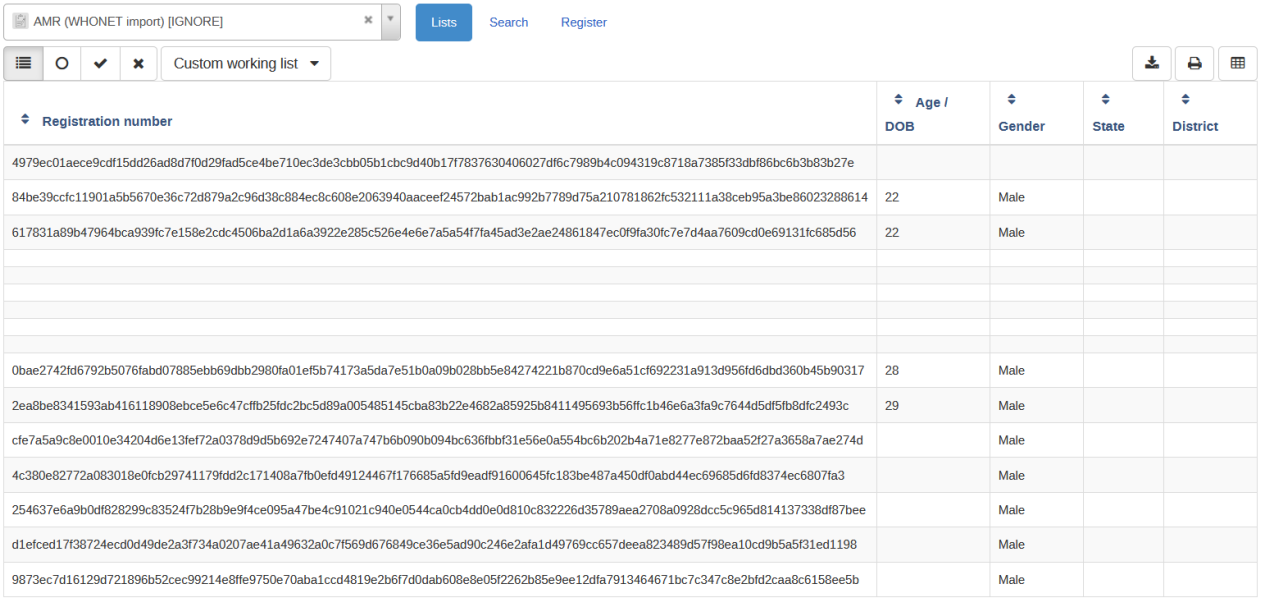


Figure 6: Registration Numbers



Registration number	Age / DOB	Gender	State	District
4979ec01aece9cdf15dd26ad8d7f0d29fad5ce4be710ec3de3cbb05b1cbc9d40b17f7837630406027df6c7989b4c094319c8718a7385f33dbf86bc6b3b83b27e				
84be39ccfc11901a5b5670e36c72d879a2c96d38c884ec8c608e2063940aaceef24572bab1ac992b7789d75a210781862fc532111a38ceb95a3be86023288614	22	Male		
617831a89b47964bca939fc7e158e2cdc4506ba2d1a6a3922e285c526e4e6e7a5a54f7fa45ad3e2ae24861847ec0f9fa30fc7e7d4aa7609cd0e69131fc685d56	22	Male		
0bae2742fd6792b5076fabd07885ebb69dbb2980fa01ef5b74173a5da7e51b0a09b028bb5e84274221b870cd9e6a51cf692231a913d956fd6dbd360b45b90317	28	Male		
2ea8be8341593ab416118908ebce5e6c47cffb25fdc2bc5d89a005485145cba83b22e4682a85925b8411495693b56ffc1b46e6a3fa9c7644d5df5fb8dfc2493c	29	Male		
cfe7a5a9c8e0010e34204d6e13fef72a0378d9d5b692e7247407a747b6b090b094bc636fbbf31e56e0a554bc6b202b4a71e8277e872baa52f27a3658a7ae274d		Male		
4c380e82772a083018e0fcb29741179fdd2c171408a7fb0efd49124467f176685a5fd9eadf91600645fc183be487a450df0abd44ec69685d6fd8374ec6807fa3		Male		
254637e6a9b0df828299c83524f7b28b9e9f4ce095a47be4c91021c940e0544ca0cb4dd0e0d810c832226d35789aea2708a0928dcc5c965d814137338df87bee		Male		
d1efced17f38724ecd0d49de2a3f734a0207ae41a49632a0c7f569d676849ce36e5ad90c246e2afa1d49769cc657deea823489d57f98ea10cd9b5a5f31ed1198		Male		
9873ec7d16129d721896b52cec99214e8ffe9750e70aba1ccd4819e2b6f7d0dab608e8e05f2262b85e9ee12dfa7913464671bc7c347c8e2bfd2caa8c6158ee5b		Male		

Figure 7: Data Entry

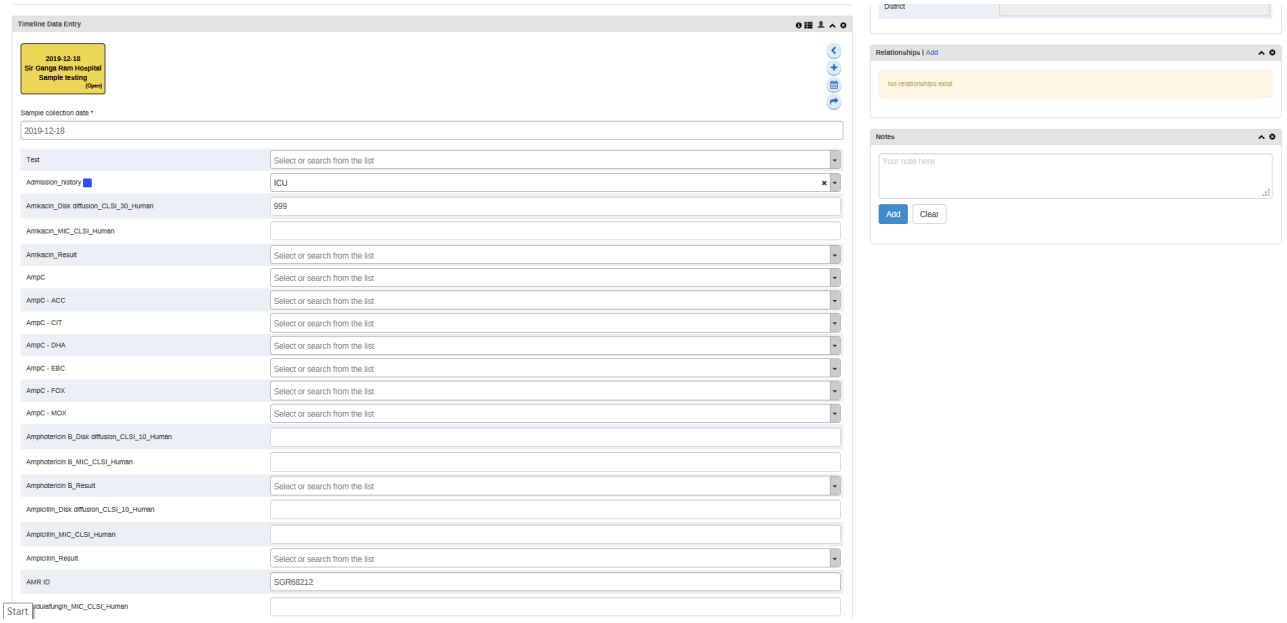
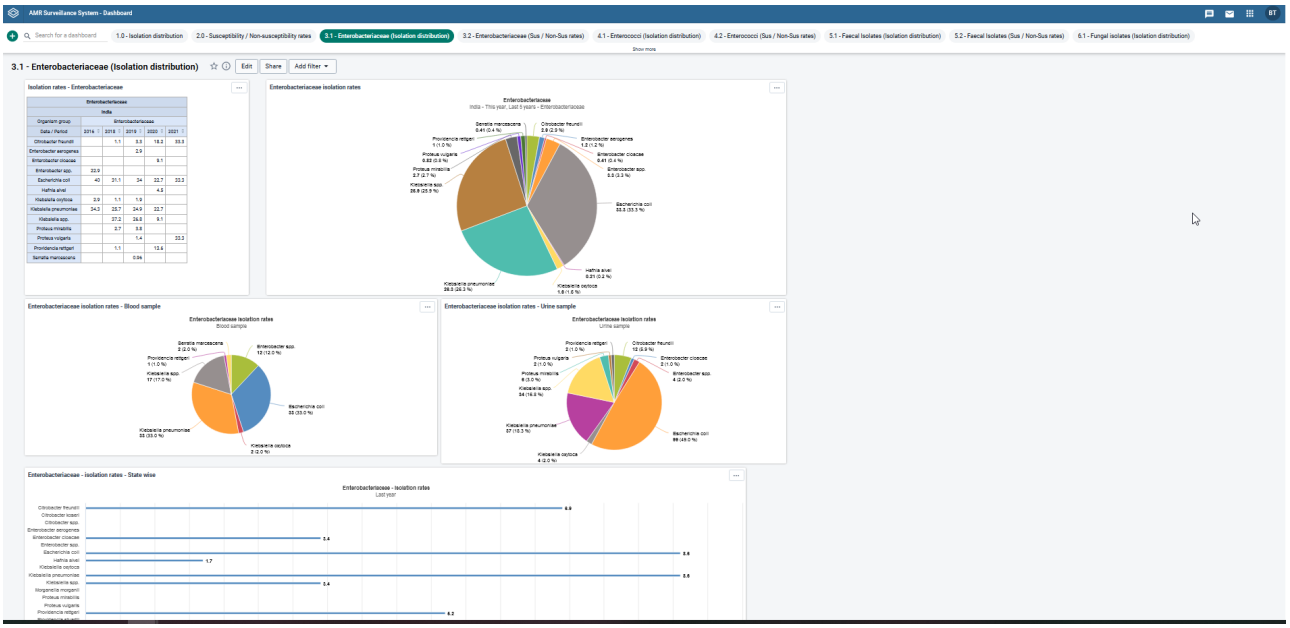


Figure 8 : User Dashboard - 2



DHIS2 Extension to the Existing App

This project is to integrate AMR Data surveillance of Right Biotic Platform with DHIS2.The machine is used to determine the sensitivity of bacteria towards various antibodies.DHIS2 can be used to centralise the existing platform, so it can be used by various people from around the world.

The update to integration can be done using WebAPI provided by the DHIS2 Platform. The Web API is a component which makes it possible for external systems to access and manipulate data stored in an instance of DHIS2. We can use Web API to grant access to the current existing app to create and modify server data.

Sending the file via POST using a json file format

```
curl -d @constant.json "http://server/api/constants" -X POST
  -H "Content-Type: application/json" -u user:password
```

Adding or removing single objects

Adding Items:

```
POST /api/categories/IDA/categoryOptions
```

Replacing Items:

```
PUT /api/categories/IDA/categoryOptions
```

Delete Items:

```
DELETE /api/categories/IDA/categoryOptions
```

CSV metadata import

```
curl --data-binary @data_elements.csv "http://localhost/api/metadata?classKey=DATA_ELEMENT"
  -H "Content-Type:application/csv" -u admin:district
```

For example POSTing CSV data value into web api

In CSV format:

```
"dataelement","period","orgunit","categoryoptioncombo","attributeoptioncombo","value"
"f7n9E0hX8qk","201401","DiszpKrYNg8","bRowv6yZOF2","bRowv6yZOF2","1"
"Ix2HsbDMLea","201401","DiszpKrYNg8","bRowv6yZOF2","bRowv6yZOF2","2"
"eY5ehpbEsB7","201401","DiszpKrYNg8","bRowv6yZOF2","bRowv6yZOF2","3"
```

Note that when using CSV format you must use the binary data option to preserve the line-breaks in the CSV file:

```
curl --data-binary @datavalueset.csv "https://play.dhis2.org/demo/24/api/dataValueSets"
  -H "Content-Type:application/csv" -u admin:district
```

Using Retrofit 2.x as a REST client

Retrofit is a REST API client for Andriod. It is relatively easy to retrieve and upload CSV and JSON files. Retrofit turns your HTTP API into a Java interface.

To work with Retrofit you basically need the following three classes:

A JSON model

Interfaces for the HTTP operations

Retrofit.Builder class - Instance that uses the interface and the Builder API to allow the endpoint for the HTTP operations.

Following are the Highlights of the code

Authentication with annotations

```
@GET("user")
Call<UserDetails> getUserDetails(@Header("Authorization") String credentials)
```

```
Credentials.basic("ausername","apassword");
```

Define the API and the Retrofit adapter

```
package com.vogella.java.retrofitgerrit;

public class Change {
    String subject;

    public String getSubject() {
        return subject;
    }

    public void setSubject(String subject) {
        this.subject = subject;
    }
}
```

Create request bodies

REQUEST BODY

An object can be specified for use as an HTTP request body with the `@Body` annotation.

```
@POST("users/new")
Call<User> createUser(@Body User user);
```

FORM ENCODED AND MULTIPART

```
@FormUrlEncoded
@POST("user/edit")
Call<User> updateUser(@Field("first_name") String first, @Field("last_name") String last);
```

Conclusion and Future work

The newly integrated app helps in tightly integrating DHIS2 and RightBiotic App. It uses the web API interface of DHIS2 and Retrofit addon for Andriod to post and get data from the main database servers.

Some improvements that DHIS2 brings to the app is that

a) It introduces a search engine for searching that can be referenced through patient id.
b) It provides an upgrade to the cloud-based system where all the users have access to the data.
c) It provides an analysis of past trends and patterns.

References

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