TRACKING AND MONITORING OF CLINICAL LABORATORY SAMPLE COLLECTION

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Abstract: Sample management is a part of process control, one of the essentials of a quality management system. The quality of the work a laboratory produces is only as good as the quality of the samples it uses for testing. The laboratory must be proactive in ensuring that the samples it receives meet all of the requirements needed to produce accurate test results. Proper management of samples is critical to the accuracy and reliability of testing, and, therefore, to the confidence in laboratory diagnosis. Laboratory results influence therapeutic decisions and can have significant impact on patient care and outcomes. It is important to provide accurate laboratory results in order to assure good treatment. Inaccuracies in testing can impact length of hospital stays, as well as hospital and laboratory costs. Inaccuracies can also affect laboratory efficiency, leading to repeat testing with resultant waste of personnel time, supplies, and reagents. To ensure that all samples are managed properly and that persons collecting samples have the needed information, the laboratory should develop a laboratory System. This system should be made available at all sample collection areas, including those that are distant from the laboratory. Collection of samples in the field for epidemiological studies should be accompanied by a form that includes the patient's name, a unique identification number, demographic information, and the patient's health status. The additional information is necessary to assist in identifying the source of an infection, and finding potential contacts.

Keywords: Tracking, Monitoring Code, Sample, Scanner.

I. INTRODUCTION

The advancement of new technologies in biomedical research has led to a dramatic growth in experimental throughput. Projects therefore steadily grow in size and involve a larger number of researchers. Spreadsheets traditionally used are thus no longer suitable for keeping track of the vast amounts of samples created and need to be replaced with state-of-the-art laboratory information management systems. Such systems have been developed in large numbers, but they are often limited to specific research domains and types of data. One domain so far neglected is the management of libraries of vector clones and genetically engineered cell lines. Our project is for sample collection, sample tracking, particularly laid out to fill this gap, but with an open architecture allowing it to be extended for other biological materials and functional data. Its sample tracking mechanism is fully customizable and aids productivity further through support for mobile devices and QR Code labels.

II. LITERATURE SURVEY

[1] End-to-End Sample Tracking in the Laboratory Using a Custom Internet of Things Device. Custom Internet of Things (IoT) device used for tracking barcoded containers end to end in a high-throughput analysis and purification laboratory device fills an important gap that previously prevented us from fully tracking barcoded sample containers through manual steps in a multistep workflow, such as when samples are "parked" for temporary storage, or when using instrumentation not otherwise equipped with barcode scanners.[2]The Enzyme Tracker: an open-source laboratory information management system for sample tracking. The Enzyme Tracker, a web-based laboratory information management system for sample tracking, as an open-source. Flexible alternative that aims at facilitating entry, mining and sharing of experimental biological data. Our system relies on a database management system for efficient data indexing and management and a user-friendly AJAX interface that can be accessed over the Internet.[3] Dynamic generation of quick response (QR) codes for secure communication from/to a mobile device Dynamically generated quick response (QR) codes are used for secure communication to / from mobile devices. QR code identifies a product or service selected by a user using a mobile device. The mobile device generates the QR code identifying the user's selection and displays the

QR code for reading by a retail kiosk. The QR code can additionally identify a user account, such that payment for the product or service is automatically charged to the account identified from the QR code.[4] A primer on theory-driven web scraping: Automatic extraction of big data from the Internet for use in psychological research. Web scraping can create massive big datasets with tens of thousands of variables, it can also be used to create modestly sized, more manageable datasets with tens of variables in a matter of hours. In this article, we demystify web scraping methods as currently used to examine research questions of interest to psychologists. First, we introduce an approach called theory-driven web scraping in which the choice to use web-based big data must follow substantive theory

III.MAIN DESIGN OF THE PAPER

Some critical samples should reach the laboratory quickly for testing in a given time. There are issues such as delay in collection of samples, prolong transport time, poor handling of samples, not maintaining proper database of samples. Eliminating these factors will result in proper handling and testing of the samples. The laboratory needs a system to allow for tracking a sample throughout the laboratory from the time it is received until results are reported.

1. To ensure that a clinical sample should reach the lab in a given time.
2. To have less human interaction in this process.
3. Using QR code for the instant transfer of the information of samples (From Hospital to Testing laboratory).
4. By using GPS module in the vehicle there is continuous tracking of samples while transportation.
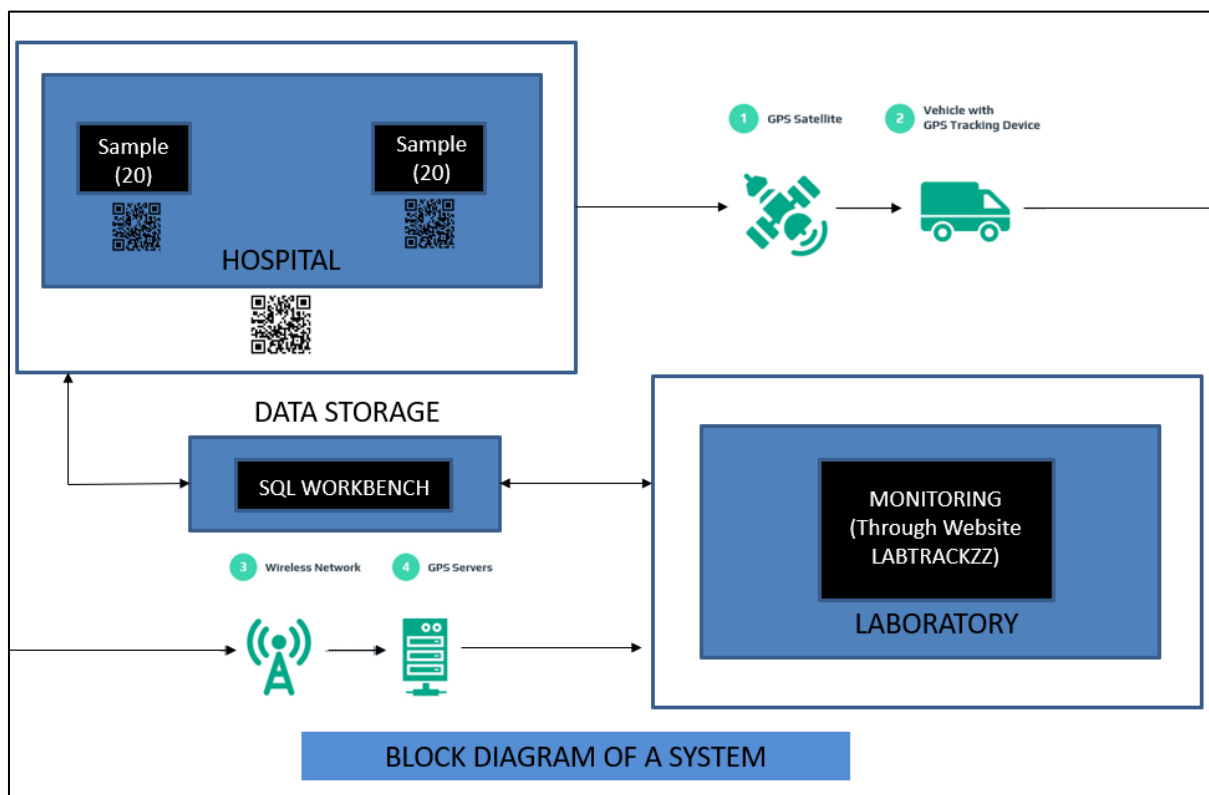5. Use of SQL workbench will give the end-to-end monitoring of actions from laboratory as well as transporting side.

Figure 1: Block Diagram of Tracking & Monitoring Clinical Laboratory Sample Collection.

A. Ublox NEO-6M GPS Module with EPROM

At the heart of the module is a NEO-6M GPS chip from Ublox. The chip measures less than the size of a postage stamp but packs a surprising number of features into its little frame. It can track up to 22 satellites on 50 channels and achieves the industry's highest level of sensitivity i.e., -161 dB tracking, while consuming only 45mA supply current. An antenna is required to use the module for any kind of communication. The module comes with a patch antenna having -161 dBm sensitivity. Fig 2
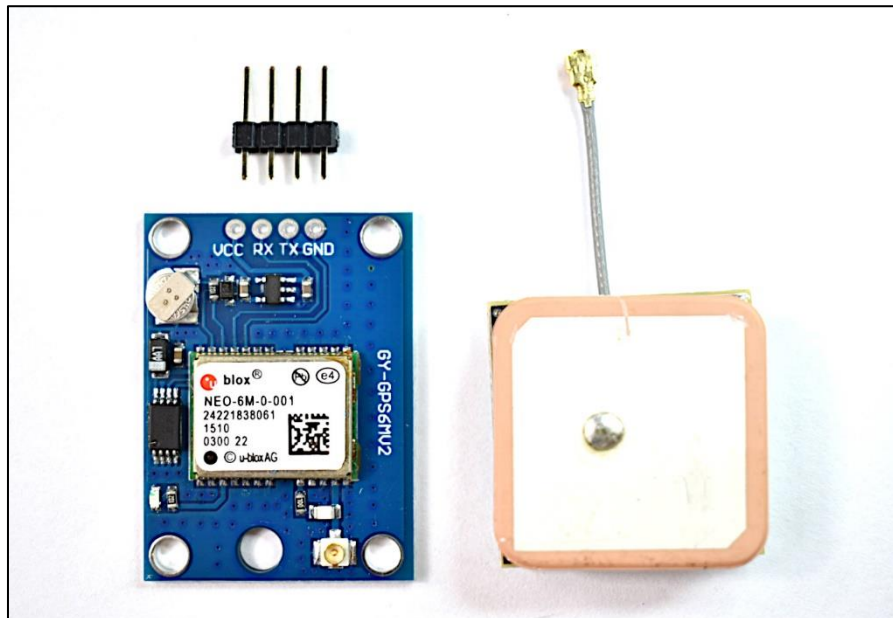
Figure 2: Ublox NEO-6M GPS Module with EPROM

B. Arduino UNO

The Arduino Uno is a microcontroller board based on the ATmega328. It has 20 digital input/output pins (of which 6 can be used as PWM outputs and 6 can be used as analog inputs), a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (ICSP) header, and a reset button.
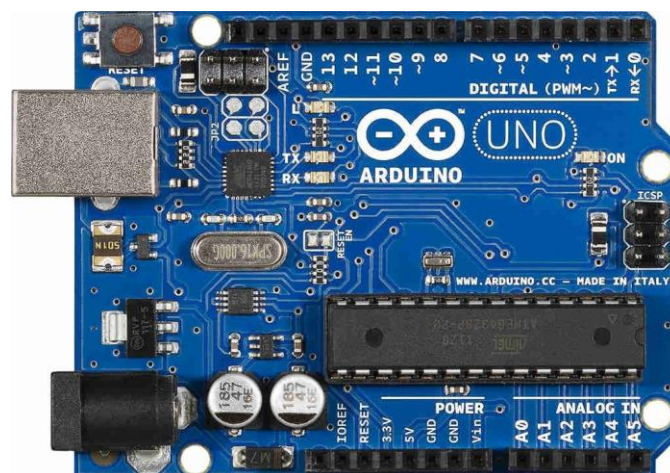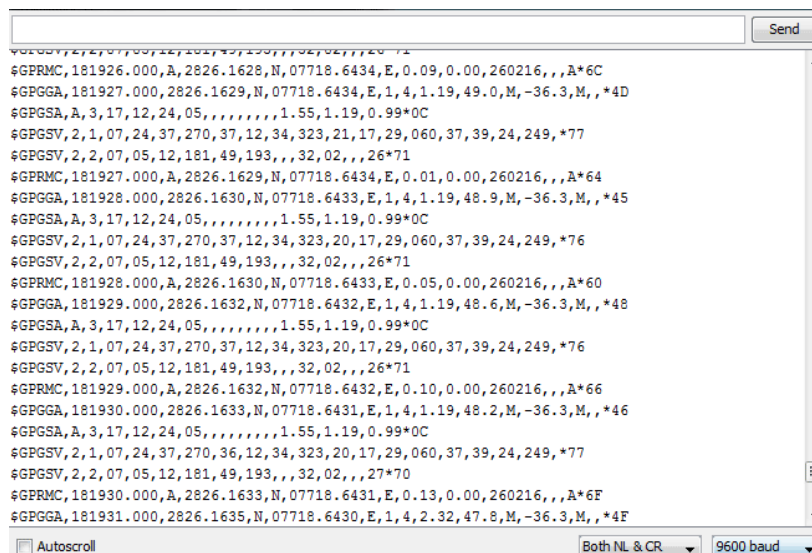
Figure 3: Arduino UNO

IV. PROPOSED METHODOLOGY AND DISCUSSION

Collecting of sample from patient of a concerned hospital. Assigning the QR code to each sample for identification and monitoring. Also assigning the QR code to the set of those samples collected from hospital. Sending data of samples to Laboratory through MySQL workbench server. Tracking of the vehicle is done by the use of GPS module. The monitoring of vehicle location is done by the concerned person from the testing laboratory. If there is any delay in the estimated arriving time of samples, the notification is sent to driver from the concerned person of testing laboratory. After arriving of the samples, the lab person can get reference from the data shared by hospital through the cloud server. In the laboratory the information of samples is extracted by scanning QR code and from the cloud. In our prototype we have mainly three blocks which consist of Hospital, Laboratory and SQL Server. In Hospital, we assign the QR code to sample which has to be sent to lab and also, we stick QR code to the container or a tray of all samples. In the next block SQL workbench is our main storage block which stores the all data comes from the hospital which are accessible to the concerned person from lab.We are using GPS module for the tracking of the samples as well as vehicle and monitoring while they travel from hospital to testing lab.In this system we are using an website Labtrackzz which acts as an interface between hospital and testing lab.Through this website we can see the status of the delivering sample and get to know about any delay in the services by taking any required steps.

V. EXPERIMENTAL RESULT

In Fig.4 GPS Module will lock the satellite for the exact location of the vehicle. The position of the is given in the terms of NMEA Codes which are displayed on the COM4 Port of the Arduino UNO through Arduino software.

Figure 4: NMEA Code Output on COM4 port of Arduino UNO

After decoding the NMEA codes with help of NMEA decoder, the location of vehicle carrying the laboratory sample is shown by the help of GPS module situated in the vehicle as shown in Fig.5
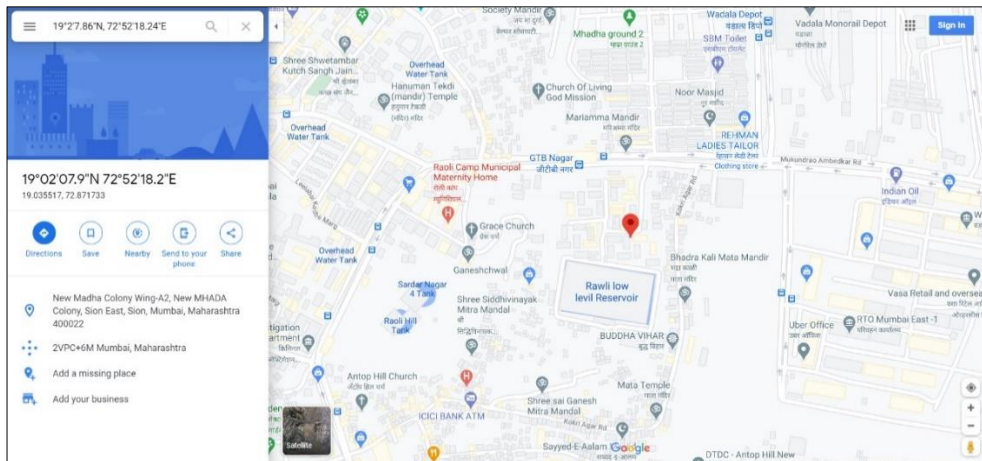
Figure 5: Location of Vehicle shown by GPS Module

For ease in transfer of information related to tracking and monitoring of sample an interface is built through website Labtrackz as shown in Fig 6.
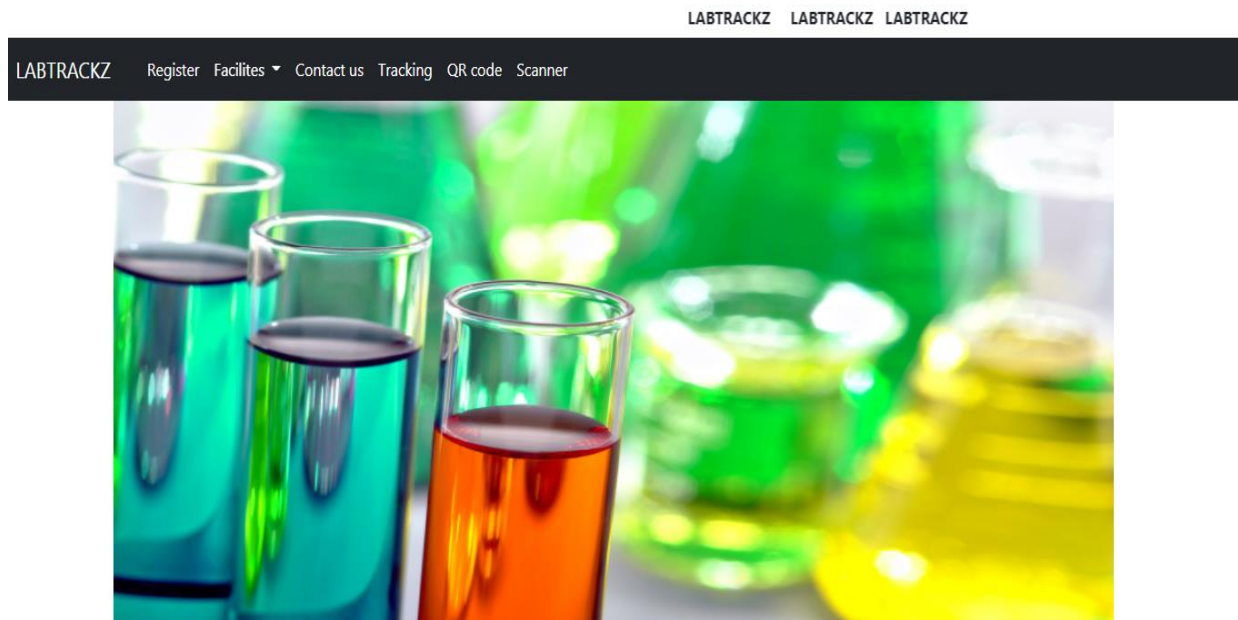

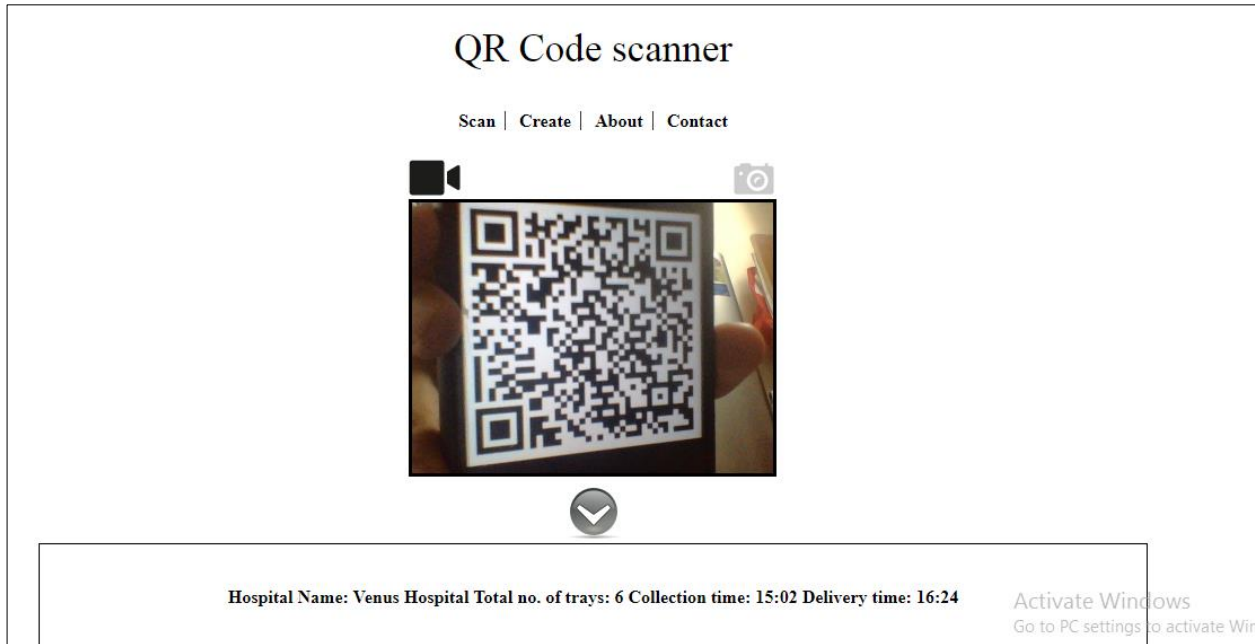Figure 6: Front end of website Labtrackz

Figure 7: QR Scanner option in the website

This option in the website is used to scan QR codes of the sample and display the information in the QR code there itself.

Figure 8: Hospital Registrations tab in website

This Tab is used by hospitals to make appointment with laboratory about the sample collection through registration.

In fig 9, database of the hospitals, samples and patients name are stored in the MySQL workbench for future use to minimise identification errors. This dataset the monitored and controlled by the laboratory operator.
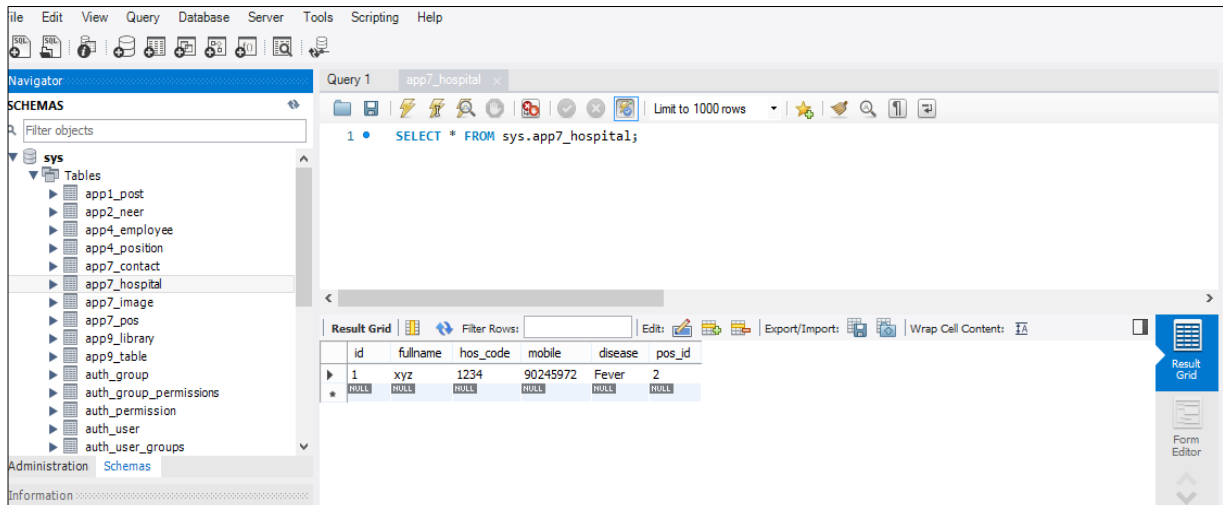

Figure 9: Database stored in MySQL workbench

VI. CONCLUSION

On the basis of previous evidences, QR coding system can be very effective in labeling and handling of the samples to reduce identification errors and improve the accuracy of patient sample and laboratory testing identification in laboratory. Our project also ensures the monitoring and tracking of sample. Due to which we can get time to time updates regarding the samples from the hospital to the laboratory with less identification errors.

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