Internship Training

at

2 Feb – 2 May 2015

Implementation of LIMS at Sanket Metropolis Health Services, Baroda

by

Dr. Ashutosh Chakraborty
(PG/13/008)

Under the guidance of

Dr. L.P. Singh
(Director, IIHMR Delhi)

Post Graduate Diploma in Hospital and Health Management

2013-15

International Institute of Health Management Research New Delhi

Completion of Dissertation

The certificate is awarded to

Dr. Ashutosh Chakraborty

In recognition of having successfully completed his
Internship in the Department of

Implementation

and has successfully completed his Project on

Implementation of LIMS at Sanket Metropolis Health Services, Baroda

2 Feb 2015 – 2 May 2015

In

Attune Technologies Pvt. Ltd

He comes across as a committed, sincere & diligent person
who has a strong drive & zeal for learning.

We wish him/her all the best for future endeavors

Dr. Atul Kothadiya
Project In charge, Mumbai
Attune Technologies Pvt. Ltd

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TO WHOMSOEVER IT MAY CONCERN

This is to certify that **Dr. Ashutosh Chakraborty** student of Post Graduate Diploma in Hospital and Health Management (PGDHM) from International Institute of Health Management Research, New Delhi has undergone internship training at **Attune Technologies Pvt. Ltd** from **2 February 2015 to 2 May 2015.**

The Candidate has successfully carried out the study designated to him during internship training and his approach to the study has been sincere, scientific and analytical.

The Internship is in fulfillment of the course requirements.

I wish him all success in all his future endeavors.

Dr. A.K. Agarwal
Dean, Academics and Student Affairs
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Dr. L.P. Singh
Director
IIHMR, New Delhi

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Certificate Of Approval

The following dissertation titled **"Implementation of LIMS at Sanket Metropolis Health Services, Baroda"** at **"Attune Technologies Pvt. Ltd.** is hereby approved as a certified study in management carried out and presented in a manner satisfactorily to warrant its acceptance as a prerequisite for the award of **Post Graduate Diploma in Health and Hospital Management** for which it has been submitted. It is understood that by this approval the undersigned do not necessarily endorse or approve any statement made, opinion expressed or conclusion drawn therein but approve the dissertation only for the purpose it is submitted.

Dissertation Examination Committee for evaluation of dissertation.

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DR. L.P. SINGH	
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Dr. VEENA SINGH	
Dr. S. SINHO.	

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Certificate from Dissertation Advisory Committee

This is to certify that **Dr. Ashutosh Chakraborty,** a graduate student of the **Post Graduate Diploma in Health and Hospital Management** has worked under our guidance and supervision. He is submitting this dissertation titled **"Implementation of LIMS at Sanket Metropolis Health Services, Baroda"** at **"Attune Technologies Pvt. Ltd."** in partial fulfillment of the requirements for the award of the **Post- Graduate Diploma in Health and Hospital Management.**

This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

Dr. L.P. Singh
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INTERNATIONAL INSTITUTE OF HEALTH MANAGEMENT RESEARCH,
NEW DELHI

CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled **"Implementation of LIMS at Sanket Metropolis Health Services, Baroda"** and submitted by **Dr. Ashutosh Chakraborty** Enrollment No. **PG/13/008** under the supervision of **Dr. L.P. Singh** for award of Postgraduate Diploma in Hospital and Health Management of the Institute carried out during the period from **2 February 2015** to **2 May 2015** embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other Institute or other similar institution of higher learning.

Signature
(Dr. Ashutosh Chakraborty)

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FEEDBACK FORM

Name of the Student: Dr. Ashutosh Chakraborty

Dissertation Organization:ATTUNE Technologies Pvt. Ltd.

Area of Dissertation: Implementation

Attendance: 95%

Objectives achieved:

- Requirement gathering& addressing issues faced by users.
- Training to end users.
- Monitor user issues.
- Increase awareness of software in users

Deliverables:

- User training for registration & accession.
- Master data for Departments.
- Bug tracker issues

Strengths:

- Hard working
- Team work
- Motivated & enthusiastic
- Multi-tasking

Suggestions for Improvement:

- Should do follow up till completion of work
- Learn thoroughly about the system

Kothadiya

Dr. Atul Kothadiya
Project In Charge
Attune Technologies Pvt. Ltd

Date: 11/5/15

Place: Mumbai

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IIHMR, New Delhi

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LIST OF ABBREVIATIONS

CAP: College of American Pathologists

CLIA: Clinical Laboratory Improvement Amendments

DEO: Data Entry Operator

GLP: Good Laboratory Practices

HIPAA: Health Insurance Portability & Accountability Act

JD: Junior Doctor

JSO: Junior Scientific Officer

LIMS: Laboratory Information Management System

NABL: National Accreditation Board for Testing & Calibration Laboratories

SD: Senior Doctor

SSO: Senior Scientific Officer

TAT: Turn Around Time

PART A

INTERNSHIP REPORT

1. INTRODUCTION

i) Organization Profile:

Attune Technologies Private Limited, a healthcare information technology company, offers Cloud-based software solutions for healthcare delivery organizations.

ATTUNE Technologies is an India based organization with its head office based in Chennai, Tamil Nadu and Singapore. The CEO is Mr. Arvind Kumar & Mr. Ramakrishnan is the COO of the organization The organization came into existence in November 2008.

ATTUNE TECHNOLOGIES offers next generation to the market with primary focus on delivering business benefits to its customers. Technology platform & architecture can serve a Single Centre as well as a National Healthcare Network. They have more than 3 million patient records on cloud. They are backed by premier investors from Singapore and US.Their unique solutions run in Metropolis, Serum, Medall Precision and many more eminent labs.Customers are in Singapore, India, Philippines, Indonesia, Kenya, Sri Lanka & Malaysia.They constantly keep innovating new solutions for the entire healthcare value chain. They now are having 250+ employees working with them since their origin.

The company offers the following:

i. *Attune Health Kernel*, a Web-based solution for hospitals that integrates its departments and branches that are geographically separated.
ii. *Attune Lab Kernel*, a Cloud-based solution for diagnostic and imaging labs that integrates its collections centers, branches, and partner networks.
iii. *Attune Clinic Kernel*, a Cloud-based solution for clinics that integrates its departments and branches when they are geographically distributed. It integrates departments from pharmacies, diagnostic labs, imaging units, physiotherapy units, wards, inpatients and outpatients units, and branches and collection centers in various geographic locations.

Clients of ATTUNE covers all over the India and abroad. The likes of Metorpolis, Ivy Group of Hospitals, Vasan Eye Care, Irene Hospitals, I-genetics, Kurunji, Billroth Hospitals, Dr. Kamakshi Memorial Hospital, IGENETICS are to name a few.

ii). Vision and Values:

Vision: To manage world's health information

Values: To provide innovative solutions to business problems by appropriate usage of technology

Transparency: Take utmost care to ensure transparency in all the engagements with all the clients and vendors. To actively share relevant information and enabling them to take informed decisions in all activities pertaining to operations.

Trust: Trust among various stakeholders is the key driver for a successful business. Attune strongly believes in this philosophy and leave no stone unturned to establish relationships based on mutual trust.

Respect: Attune strongly value the relationships with all our stakeholders and greatly respect their needs and decisions. Mutual Respect and Understanding is the cornerstone of all their relationships.

Win-win - Attune strongly believes in establishing win-win relationships with all our stakeholders. Engagements with customers and vendors shall be based on evolving long-term win-win relationships.

iii). Work culture at Attune:

Work culture at Attune includes:

- Entrepreneur
- Team work
- Positive contribution

Entrepreneur: Culture and Innovation actively foster Entrepreneurship and Innovation across the organization. In this era of Knowledge Economy, Attune strongly believe that the most valuable asset of an organization is its human talent. By promoting Informed Risk taking, we provide the ability to tap the combined potential of individual team members to add more value to our customers. For us, encouraging Innovation involves fostering a culture of applying un-

conventional ideas to solve everyday business problems of our Customers. By challenging ourselves and practicing a vibrant and informal work culture, we ensure constant flow of ideas and suggestions across the organization.

Team work: One of the critical success factors of our business model is the ability of our project teams to deliver effective solutions to our Customers. This requires seamless co-ordination and transfer of knowledge among various specialized teams. Ability to work in cross-functional teams is a key pre-requisite for any member coming on board. Our Recruitment, Retention, Reward & Recognition Policies are aligned to foster and encourage team work across all levels of the organization.

Positive contribution: The organization promotes a culture where everyone is free to challenge the ideas of any other person in the organization. Every employee is expected to positively challenge the issues and come out with alternatives and in the end, the valid propositions are accepted based on objective discussions. Once a decision has been arrived at, the team goes ahead implementing it without postponing any further.(1)

2. AREA OF ENGAGEMENT: The area of engagement in the organization during the internship was implementation of Attune LIMS in one of the organization's customer. The customer is having chain of laboratories indifferent parts of India and many of the customer sites have been implemented with the Attune LIMS.

3. KEY LEARNINGS DURING INTERNSHIP:

- Understanding ATTUNE LIMS software
- Understanding Lab workflows
- Master data preparation and verification
- Requirement gathering for Departments
- Mapping of Departments and report formats
- Live issues faced by end users
- Training given to end users
- Handling, responding and delegating issues in complaint tracker
- Tracking samples which are unprocessed and informing departments about the same
- Phase wise implementation process is more practical and feasible.
- Managing client feedback is the key of successful implementation.
- If the Organization is using an IT system beforehand then the new product must be developed such that it is compatible with the old one.

PART B

DISSERTATION REPORT

DISSERTATION OVERVIEW

This dissertation is based on covering the implementation phases for Attune LIMS at Sanket Metropolis Health Services, Baroda to prepare it for the final Go-Live phase, to reduce the risks and to increase the probability of implementation success.

1.INTRODUCTION

LIMS (Laboratory Information Management System) is a computer based solution providing streamlined workflow automation and management in the laboratory. LIMS also offers relevant structured information, extensive reports for the business as a whole and integrates with other applications for maximum business efficiency. A LIMS provides a way of automating part of the laboratory system. In a traditional laboratory 75% of the total cost comes from manpower. Removing the need for some human interaction can significantly reduce overheads. The primary function of most laboratories is to provide validated information under some sort of time constraint and then based on that information, allow customers to make decisions[(3)]. A LIMS can be ofgreat importance in integrating laboratory operations with the laboratory itself. One of the most important aims of a LIMS is the integration of many different sub processes, bringing together and consolidating the efforts of potentially many individuals and consequently speeding up the whole process. LIMSs can save considerable amounts of time and dramatically improve the level of data access for all stakeholders of any given project. This is where a LIMS can become extremely beneficial. The sooner the user is notified of a problem, the sooner that problem can be fixed and the less the solution will cost[(4)]. The ideal LIMS should help provide the documentation to ensure that a laboratory and all of its operations exist in compliance. There are a number of benefits LIMS brings to the laboratory environment, most notably; increased productivity and improved data quality, both of which drive reduced operating costs whilst freeing up valuable human resources from routine tasks. The system can embrace the way one works, single sample, batch samples and manual or automated methods, producing reports for internal and external customer use.

2. PROBLEM STATEMENT

A scenario has come that in spite of taking all the precautions during the development and coding for any LIMS implementation do fail and not always adoption rate in users could be the excuse for the blame game. The reason being the lack of emphasis on the pre-implementation phases especially requirement gathering & solution mapping, configuration of masters & different types of testing of the software before the final implementation or the go-live takes place which subsequently results in requirements and expectations of the end users remained unmet. What was wanted and what has been given to them at the end of the project for which they have invested crores of rupees is of great importance for success & failure of any LIMS implementation project. At the end of the day what actually matters is the satisfaction & acceptance of the implementation by the customer, which is directly proportional to the success rate of any LIMS implementation. The study is based on understanding the pre-implementation phases and standardizing them for successful implementation.

3. SCOPE OF PROJECT

A LIMS provides benefits for many of the users in a laboratory. Information can be obtained with the click of a button rather than having to dig through files. Years of data can be kept easily without the need for traditional archiving & improvement of business efficiency.

Patient can be registered easily and details are maintained for long time. Sample transferring and receiving are made easy. Interfacing and manual processing of the samples becomes easy with Attune LIMS, results undergo four levels for checking which ensures accurate results and quality, also report dispatch mode becomes easy when auto generated e-mail with report goes to patient once report is approved by Doctor.

4. REVIEW OF LITERATURE

- Ben Tagger Computer Science Department from University of Wales did study on Implementation of LIMS in *Analytical Chemistry lab in* Wales and found out that implementing a LIMS is an extremely expensive process, one which must be improved considerably if it is to become more widely available. There are various ways to reduce this risk of failure but none of the processes provide a total, ideal solution. The guidelines for successfully implementing a LIMS are useful but are by no means complete.

- McDowall, R.D. A Matrix for the Development of a Strategic Laboratory Information Management System did study on 6 steps of successful LIMS implementation and found out that doing it on your own, bypassing training, counting too much on customization, not engaging the full team are some flows which we should avoid while implementing LIMS.

- Dr. Sepulveda and Dr. Young from the Department of Pathology & Laboratory Medicine, University of Pennsylvania, Philadelphia did study on The Ideal Laboratory Information System and found Laboratory information systems (LIS) are critical components of the operation of clinical laboratories. However, the functionalities of LIS have lagged significantly behind the capacities of current hardware and software technologies, while the complexity of the information produced by clinical laboratories has been increasing over time and will soon undergo rapid expansion with the use of new, high-throughput and high-dimensionality laboratory tests. In the broadest sense, LIS are essential to manage the flow of information between health care providers, patients, and laboratories and should be designed to optimize not only laboratory operations but also personalized clinical care. Objective.-To list suggestions for designing LIS with the goal of optimizing the operation of clinical laboratories while improving clinical care by intelligent management of laboratory information. Data Sources.-Literature review, interviews with laboratory users, and personal experience and opinion. Conclusions.-Laboratory information systems can improve laboratory operations and improve patient care. Specific suggestions for improving the function of LIS are listed under the following

sections: Information Security, Test Ordering, Specimen Collection, Accessioning, and Processing, Analytic Phase, Result Entry and Validation, Result Reporting, Notification Management, Data Mining and Cross-sectional Reports, Method Validation, Quality Management, Administrative and Financial Issues, and Other Operational Issues.[5]

5. OBJECTIVES OF THE STUDY

General objective:

To understand the working of the LIMS and to test the module in Sanket Metropolis Health Services, Baroda.

Specific Objectives:

- To understand the workflow involved in implementing LIMS
- To identify the various use cases of the LIMS modules
- To test the module by using dummy registrations
- Understand the issues that arise during registration

Research Questions:

The following questions were addressed based on the above objectives

- What are the features of the LIMS module?
- What are the data that need to be mapped to the master data?
- How is the registration module of the LIMS working?
- What are the issues that arise when registration is performed through LIMS?

6. METHODOLOGY

Study organisation: Sanket Metropolis Health Services, Baroda

Study location: Haematology Department, Clinical Biochemistry Department, Immunology Department.

Study design: Observational study

Data Source

- Primary Data : - Hypothetical Data for dummy registrations (Two cycles)
- Secondary Data :- Manual, existing master data, check list, use case document

Tools Utilized:

- Use case diagrams & descriptions, activity diagrams, data flow diagrams
- Excel sheets to map the master data

7. Gantt Chart

Activities	Time (In Weeks)						
	01	02	03	04	05	06	07
Configuration							
Testing, Support & Internal Acceptance							
Master Data							
User Training							
User Evaluation Test							
Parallel Run							
Go Live							
Daily Reporting							

8. BACKGROUND OF THE PROJECT

Processing over 10 million tests a year, catering to more than 10,000 Laboratories, Hospitals, Nursing Homes and 20,000 Consultants, with 31 years of experience delivering accurate reports, Metropolis has earned the reputation of being India's only multinational chain of diagnostic center with presence in The UAE, Sri Lanka and South Africa. Since its inception in 1981 as a purely Mumbai based lab, Metropolis has come a long way. Visionary Leadership, strategic associations with other leading laboratories across the country, strict ethical policies and a penchant for technology are some of the reasons Metropolis is India's largest laboratory chain. NABL, CAP (College of American Pathologists) accreditation (Mumbai) reiterates that it meets stringent national and international quality requirements – imperative in a vital service sector like Healthcare.

Metropolis has more than 105 state-of-art-laboratories across India, UAE, Sri Lanka, South Africa and Bangladesh etc. with over 700 collection centers further demonstrates how committed Metropolis is in delivering accurate and timely results across the 4500 plus routine, specialized and highly specialized investigations, investigations that use over 100 different technologies including Biochip and DNA Sequencing. Innovations like Home Health Services enables Metropolis to reach patients / people so that going for a checkup is no longer an inconvenience.

Metropolis supports the global Endeavour to fight disease by incorporating cutting edge technology and practices that work hand in glove with awareness drives and health checkup camps. Metropolis's capability to carry out health checkups and testing across large geographies ensures that companies can be assured of consistent results and unique loyalty programmers provides the customers with even more reasons to get health checkups done. After all in the battle against disease, diagnosis is the first step. Metropolis services include Clinical Laboratory Medicine, Hospital Laboratory Management, Central Laboratory Services for Clinical trials, Home Health Services and Preventive Health Checkups. Metropolis is at many places, it was using Metro lab everywhere but Metro lab was not at all connected with each other so for the connectivity purpose they needed to work on paper and lots of paper work was involved because to process the samples, the samples were needed to be transferred to processing location from the respective collection centers but without paper work it was not possible, so with every sample

they needed to send paper mentioning about processing location. Metro lab was web enabled software so was only available in Metropolis systems and it was difficult to operate from remote location. Due to lots of paper work quality was not maintained and many mistakes were happening. Metropolis is expanding their locations but due to the above reason they are unable to do so, samples coming from far locations, sometimes they missed the TAT (turnaround time) due to this confusion the biggest problem was with authorization of the report. Metropolis has different departments having many doctors who are the Head of the Department, reports which were validated from Sr. Scientific Officer used to come to all Doctors log in, so every Doctor could see reports from all departments which lead to confusion and mistakes. Some doctors used to approve reports of other department, so patient used to get faulty report. To overcome such situations Metropolis decided to tale with Attune LIMS, where Attune had segregated all locations as Org and Locations. Places which have different locations are named as Org. under every Org places which have similar work flow as named as Location. For e.g. Baroda is a processing location and it has same work flow like Navjeevan Collection Center, So Baroda is an Org where Baroda, Navjeevan are locations. Users can select locations under Org and can do sample transfer.

In Attune lots of paper work was reduced as users can have sample transfer option and receive option and batch sheet option to reconfirm number of samples. Attune started with a concept of Department mapping, where Hematology HOD is only mapped with Hematology department and so with other departments. This solved the problem of Doctor approving report of other departments. Jr. Scientific Officer and Sr. Scientific Officer are also mapped with departments so they can have access to their respective departments.

9. RESULTS & DISCUSSION

The results are explained in three parts

1. Steps involved in Implementation as followed by the organization
2. Workflow of the LIMS
3. Testing of Registration Module

Part 1. Steps in Implementation process:

1) Requirement gathering: Report formats and requirements (output) were asked from Department Head and users and input for result entry page are gathered and documented and were compared with Metro lab report formats and decided whether to make new report formats or not.

2) Master Data: Test code, Test name, Abbreviation, Display name, Department name, Section name , Test group, Test Method, Container units, Sub category, Processing location, Interface information this information is gathered and documented in excel sheet for tests, groups and panels and send to Technical team for backend uploading, when uploading was completed Master data was verified.

3) Co-ordination with IT team: As planned for every Department's implementation 1 person from ATTUE and 1 person from Metropolis IT team was responsible, it was important to gather information for master data in co-ordination with IT team. Some changes were needed to be made from front end and was taught to Metropolis IT team so that in future any problem with existing data arises IT team can modify as per requirement.

4) Co-ordination with Technical Team: As per requirements, input and output needs were understood and explained to technical team. Technical team made new report formats as per Department request and input formats.

5) *Mapping of the formats to test parameters:* After master data upload and output input formats made, mapping of the formats are done with all test parameters. Dummy registrations and result entry were done to check mapping.

6) *Output modifications:* After mapping check with dummy registration and as per needs output pattern were modified accordingly.

7) *Signing off report formats:* Report formats were shown to Head of Department and sign off was taken.

8) *User training:* Power point presentations were made for user training and manual was given to users and extensive training was given to all users.

9) *Go-Live:* After successful user training and parallel run technical team was advised to move data to LIVE environment.

10) *Support:* After moving to live environment, support is given to Department for issues faced by users. They are identified as user training gaps, system bug, not an issue or master data issue and resolved and fixed accordingly.

Attune has made a web based software which will help for quick registration, quick processing and rechecking results. Metropolis has two types of clients B2B and B2C.

In Attune LIMS Dummy registrations were done to check the input and output patterns of the Investigations, and the report was shown to the respective Department Heads and incase of any changes required was noted and send to the backend team to make necessary changes in the input and output pattern. This was done for all the investigations.

Part 2. Attune LIMS work flow:

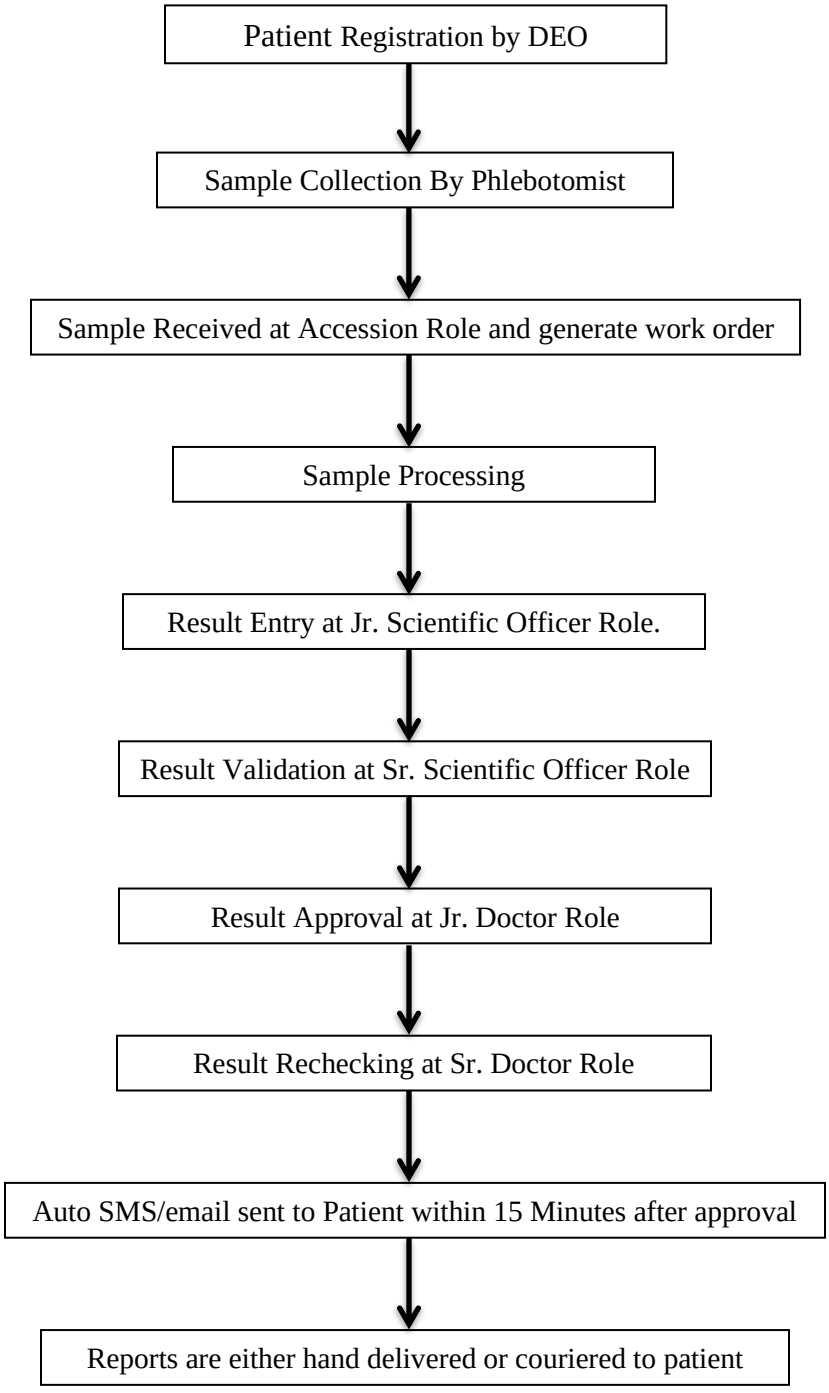
1. DEO registers the patient & enters patient registration details.
2. Once patient is registered VID (Visit ID number) and PID (Patient ID no.) is generated. Sample is collected from the patient; barcode which has the test name with Barcode number, patient's name, age, sex, date of registration, time of registration, sample name, container name and VID is generated and is attached to sample tubes or container.
3. Sample is received in accession department and work orders are made for processing and then samples are sent to respective departments for processing. In the departments samples are received and processed either by interfacing or manually.
4. Processed results are entered in LIMS by Junior Scientific Officer, work list are taken in department so that no sample is missed. According to work list samples are processed and results are entered for manual test and for interface able tests values are directly pushed from the machine. Report is then completed and sent for validation.
5. At validation level report values are checked and report is validated by Senior Scientific Officer and sent for approval.
6. Junior and Senior Doctor approve the report and auto generated sms and email is sent to the patient.

For Metropolis implementing Attune LIMS was a process change. The whole process of registration and sample processing was changed. Attune LIMS was web enabled so that patient can be registered from remote location.

Roles in Attune LIMS:

- DEO / Receptionist for patient registration and report dispatch
- Phlebotomist for sample collection
- Accession for sample transfer and sample receive
- Junior Scientific Officer for processing Test and entering the result
- Senior Scientific officer for result validation
- Junior and Senior Doctor for report approval

Fig: Attune LIMS Work Flow



Part 3: Testing of Registration Module

The list of variables in the registration Module are

- Name of the patient
- Sex
- Age
- Marital Status
- Contact no. and e-mail id
- Address
- Referred by (Doctor Name / Hospital Name)
- Phlebotomist name
- Test name

Dummy values were entered for each and every variable and working of the registration module was checked.

The following lists of tests were performed

1. Login ID & Password: - Here the validity was checked to see based on the number of incorrect logins by the user. Default – Three incorrect attempts are allowed.
2. Login ID & Password: - Verification of user was checked to see the access by entering the login & password of the user already registered.
3. Name of the Patient : Any combination of letters, numbers were allowed.
4. Sex : - Automatic updation of the gender based on the title was checked. If the name was entered with prefix Dr, the system should allow manual entry of the gender
5. Age: less than 0 years was checked
6. Marital Status: If Mrs is entered before name the state should be updated as married. For men manual updation should be allowed
7. Contact No : Tested for 11 digits
8. Email: Tested for valid email entry. Providing "@" was mandatory
9. Address: Optional
10. Referred By: Here entry for Doctor Name was compulsory-. If the patient visits on his/ her own then it was entered as 'self'
11. Phlebotomist name: was to be manually entered.
12. Test Name: Test name was selected from the list of Investigations, Groups and Packages

Nearly 100 test cases were made using dummy registrations issues were noted, their causes identified & steps taken to resolve them.

S.No	Issues	Causes	Actions Taken
1	Test names and rates were listed incorrectly at few instances	Mapping of the collected data & master data not done	The correct data requirements collected from the forms and mapped in the master data of the LIMS module
2	Wherever the test names and values were entered in free style, the system was unable to display the details of the test; - its name, price etc	The values entered were qualitative. Eg., if "haemoglobin" was entered instead of "hemoglobin" system was unable to display.	Temporarily the module has been mapped to disply 'haem'. Still the issue is open.
3	Work orders were not displayed in few cases	The mapping was either unavailable or incorrect. Unmet or incorrect requirement	Mapping of missing sample container & sample name done.
4	The reference rates and units of measurements of few test cases actually measured (utilized) and those displayed in the module were not matching.	The references actually used in lab tests and those entered were mismatch. Incorrect requirement	The requirements collected from the ned users & forms and mapped in the module.
5	The report formats for few tests were not as per the physician's requirement	Unmet requirement of the physician	The templates were customized to suit physician needs
6	The users were locked out in few cases and pages were not loaded properly.	Due to internet speed (Network problem)	The speed of internet connectivity has been increased. But the problem persists in few cases

10. USE CASES

Stake holders:

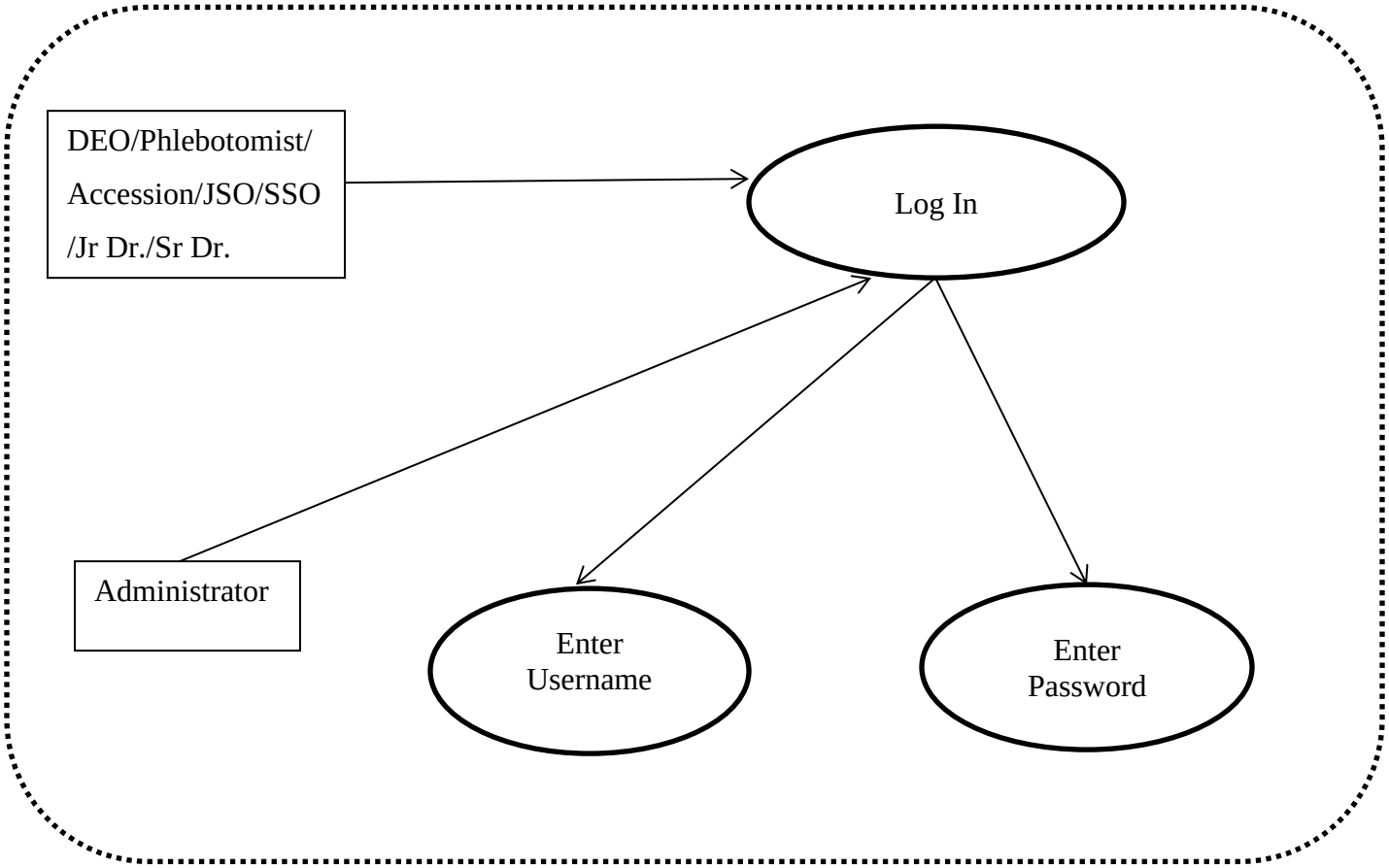
1. DEO (Data Entry Operator)
2. Phlebotomist
3. Accession
4. Jr. Scientific Officer
5. Sr. Scientific Officer
6. Jr. Doctor
7. Sr. Doctor

10.1 Use case Description and Use Case Diagram:

Use Case Number	10.1 General
Use Case Name	Stake holders Log In
Description	User wants to enter ino the system
Basic Flow	• The use case begins when the user wants to use the system ATTUNE LIMS • The user enters His / Her user id and password. • He / She presses enter • The user is successfully logged in The use case ends
Alternate Course A	• ID and password rejected by application • Login failed
Pre-conditions	• System with internet connection should be available • The user should have Id and password
Post Condition	• User successfully log in into system

10.1 Use Case No. General

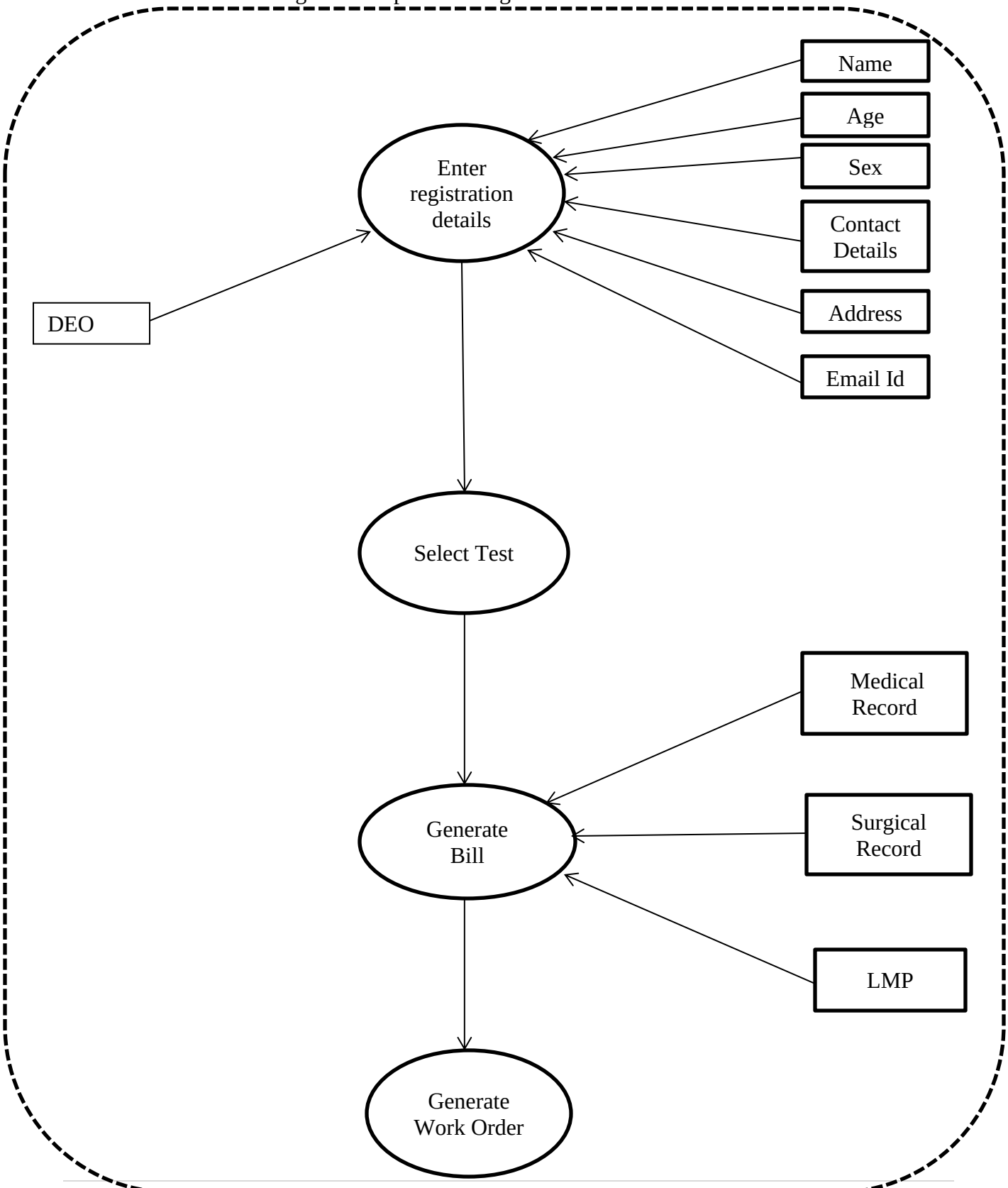
User Case Name: Stakeholder log in



10.2 DEO registers the patient and generates the bill.

Use Case No.	10.2
Use Case Name	DEO registers the patient and generates the bill
Basic Flow	• The use case begins when the user wants to register the patient and generate bill. • Enters registration details of the patient. • Select the test • Select discount if applicable • Generate bill • Generate work order The use case ends
Alternate Course	• DEO do not register patient • DEO do not generate work order
Pre-conditions	• System with internet connection should be available • Barcode should be installed printer should be connected with the system
Post condition	• DEO successfully registers the patient and generates the bill

Use case number: 10.2
Use Case name: DEO registers the patient and generates bill.

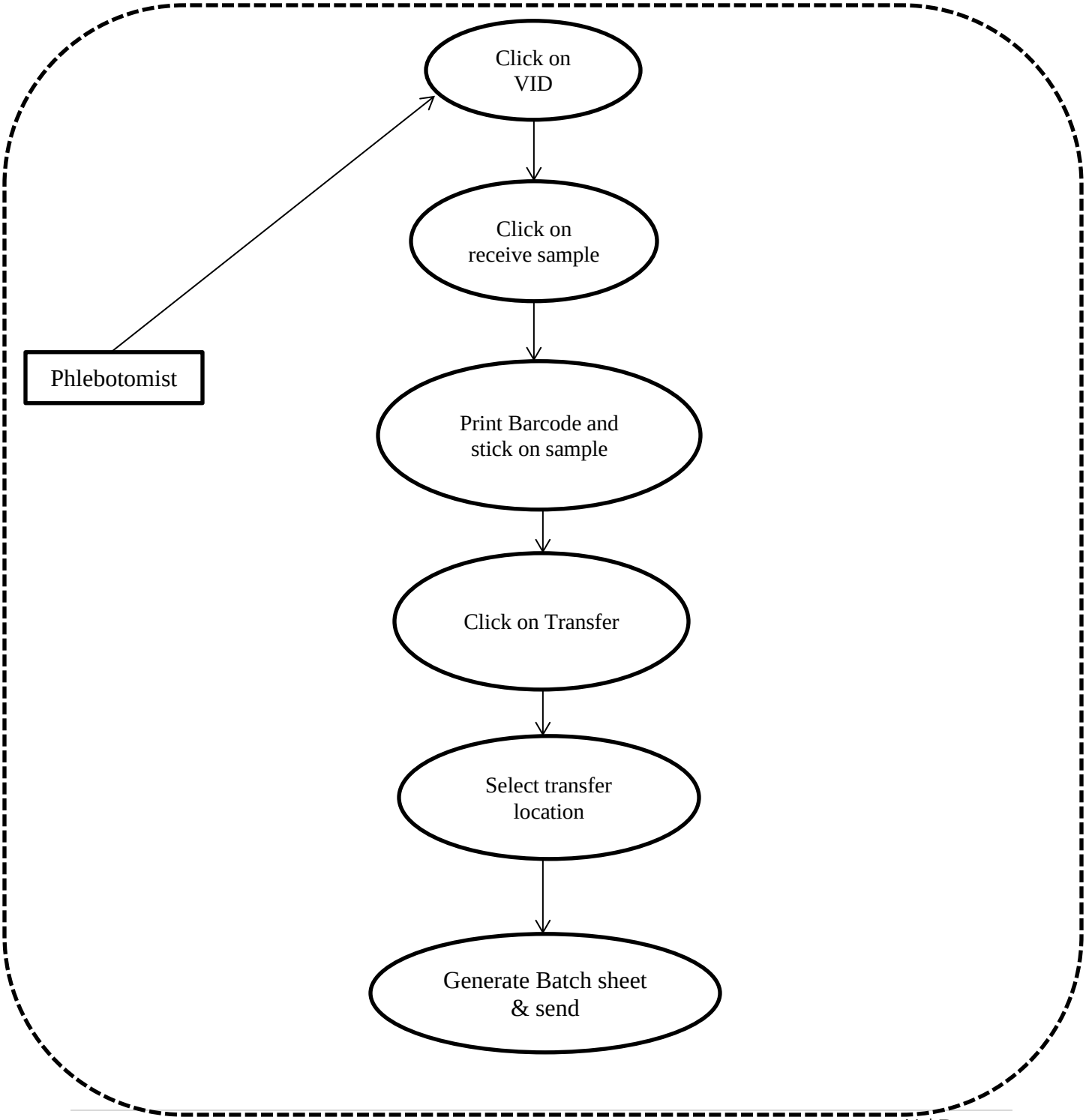


10.3. Phlebotomist receives the sample and transfers it to the processing location

Use Case No.	10.3
Use Case Name	Phlebotomist receives the sample and transfers it to the processing location
Basic Flow	• The use case begins when the user (phlebotomist) receives the sample and transfers it to the processing location • Click on VID • Generate barcode • Click on transfer sample • Select transfer location • Generate and send batch sheet The use case ends
Alternate Course	• Sample is not received • Sample received but not transferred • Batch sheet not generated
Pre-conditions	• System with internet connection should be available • Barcode should be installed • Printer should be connected with the system
Post condition	• Phlebotomist receives the sample and transfers it to the processing location

Use Case No. 10.3

Use Case Name: Phlebotomist receives the sample and transfers it to processing location.

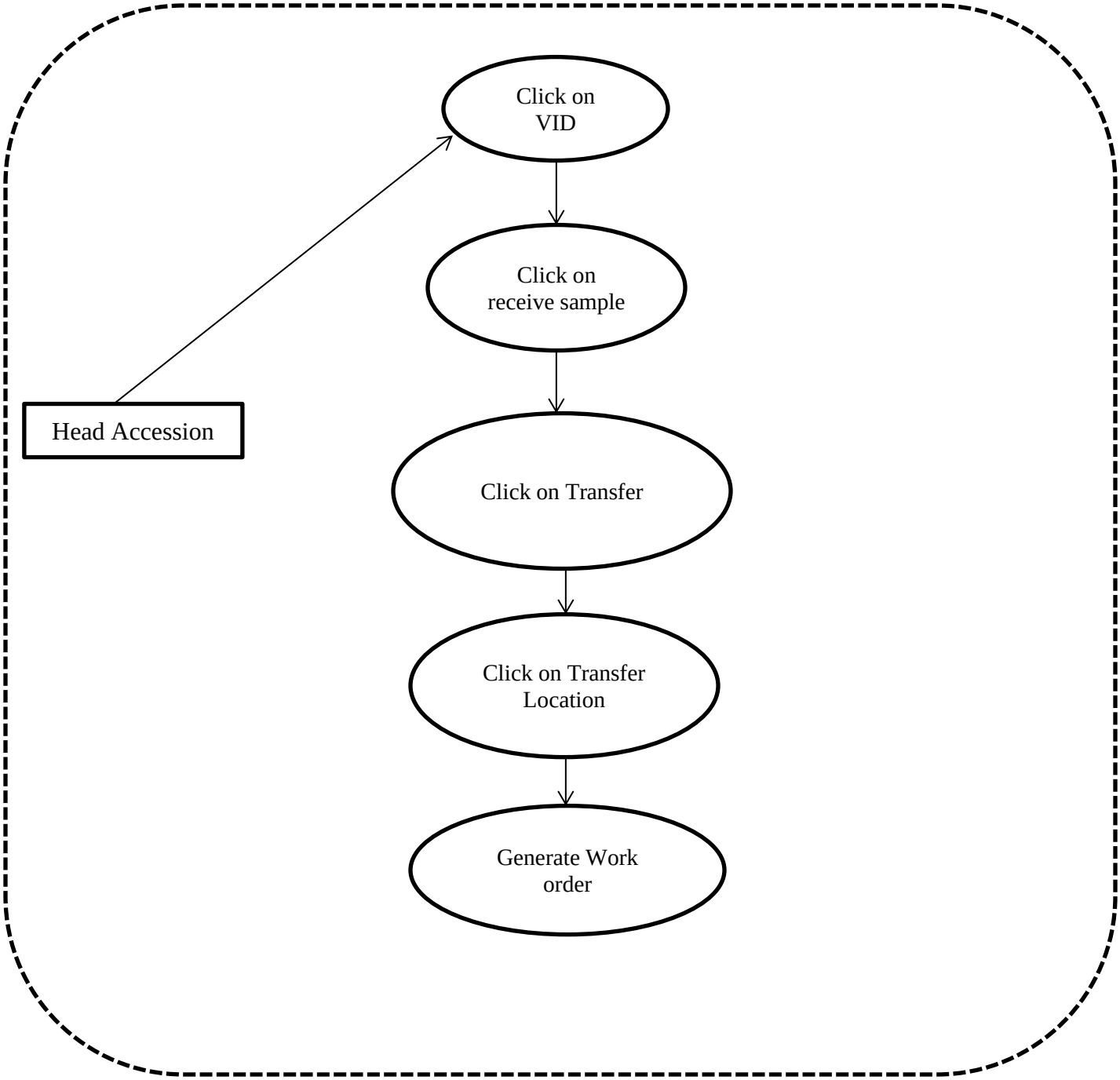


10.4. Head Accession receives the sample and transfers it to the processing department

Use Case No.	10.4
Use Case Name	Head Accession receives the sample and transfers it to the processing department
Basic Flow	• The use case begins when the user (Head Accession) receives the sample and transfers it to the processing department • Click on VID • Click on receive sample • Click on transfer sample to processing department • Generate work order The use case ends
Alternate Course	• Sample is not received • Work order is not generated
Pre-condition	• System with internet connection should be available
Post condition	• Head Accession receives the sample and transfers it to the processing department

Use Case No. 10.4

Use Case Name: Head Accession receives the sample and transfers it to processing department.

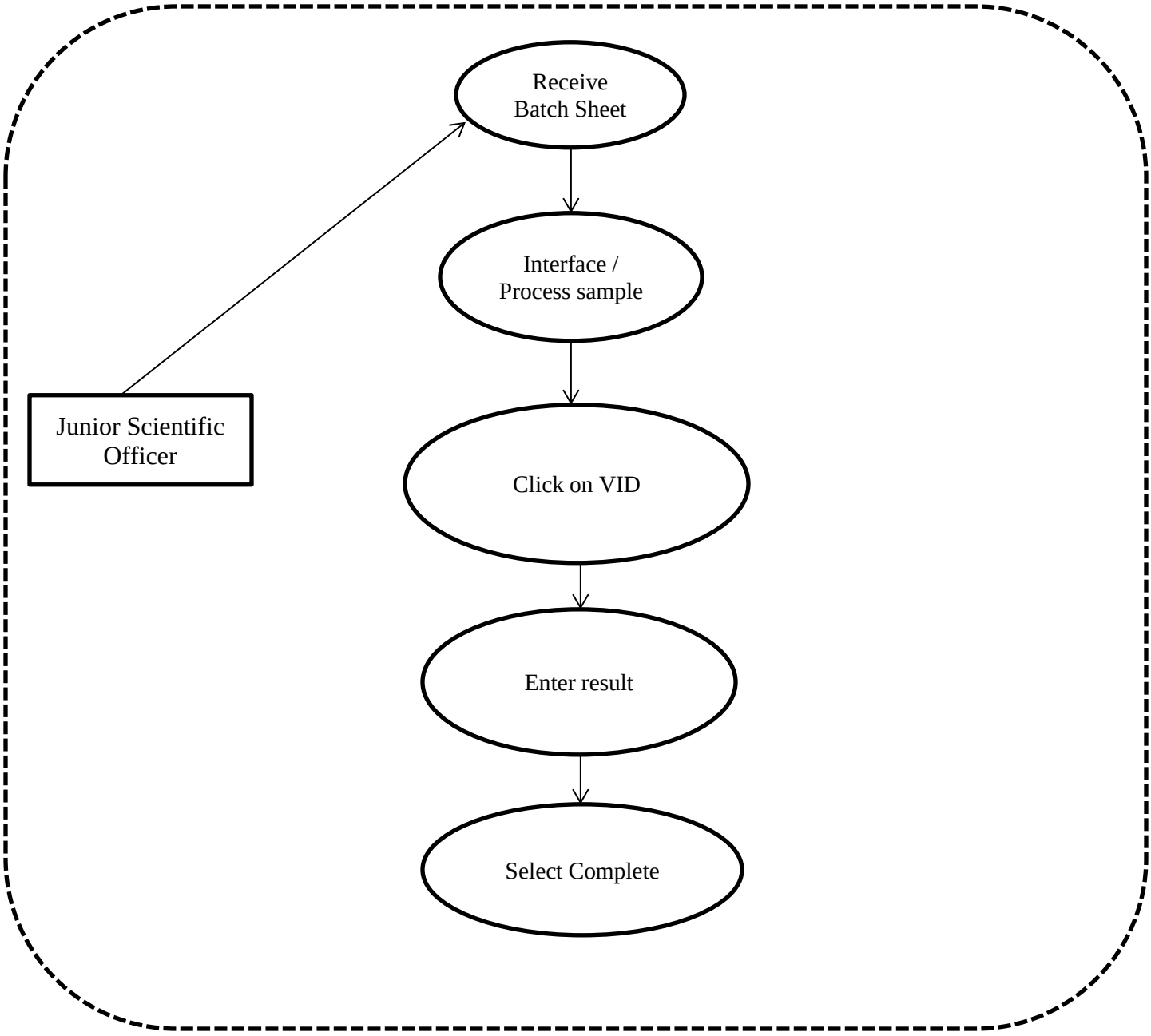


10.5. Junior Scientific Officer processes the sample and enters the result

Use Case No.	10.5
Use Case Name	Junior Scientific Officer processes the sample and enters the result
Basic Flow	• The use case begins when the user (Junior Scientific Officer) process the sample and enters the result • Do interface / sample processing • Click on VID • Enter result • Select complete The use case ends
Alternate Course	• Sample is not received • Work order is not generated • Result not entered
Pre-condition	• System with internet connection should be available
Post condition	• Junior Scientific Officer process the sample and enters the result

Use Case No. 10.5

Use Case Name: Junior Scientific Officer processes the sample and enters the result

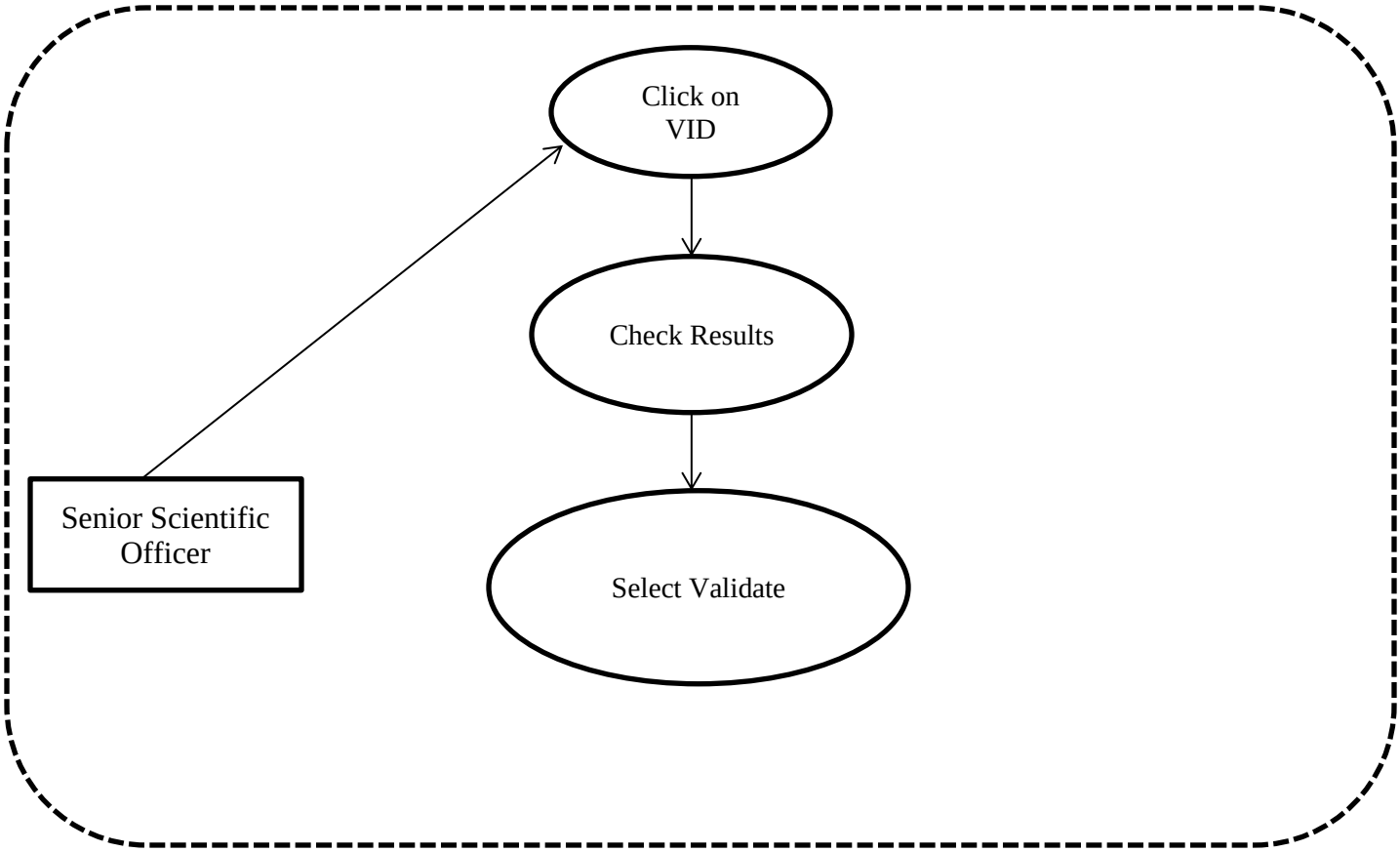


10.6. Senior Scientific Officer validates the result

Use Case No.	10.6
Use Case Name	Senior Scientific officer validates the result
Basic Flow	• The use case begins when the user (Senior Scientific Officer) validates the result • Click on VID • Check the result • Select validate The use case ends
Alternate Course	• Result partially validate • Sample Re run
Pre-condition	• System with internet connection should be available
Post condition	• Senior Scientific Officer validates the result

Use Case No. 10.6

Use Case Name: Senior Scientific Officer validates the result

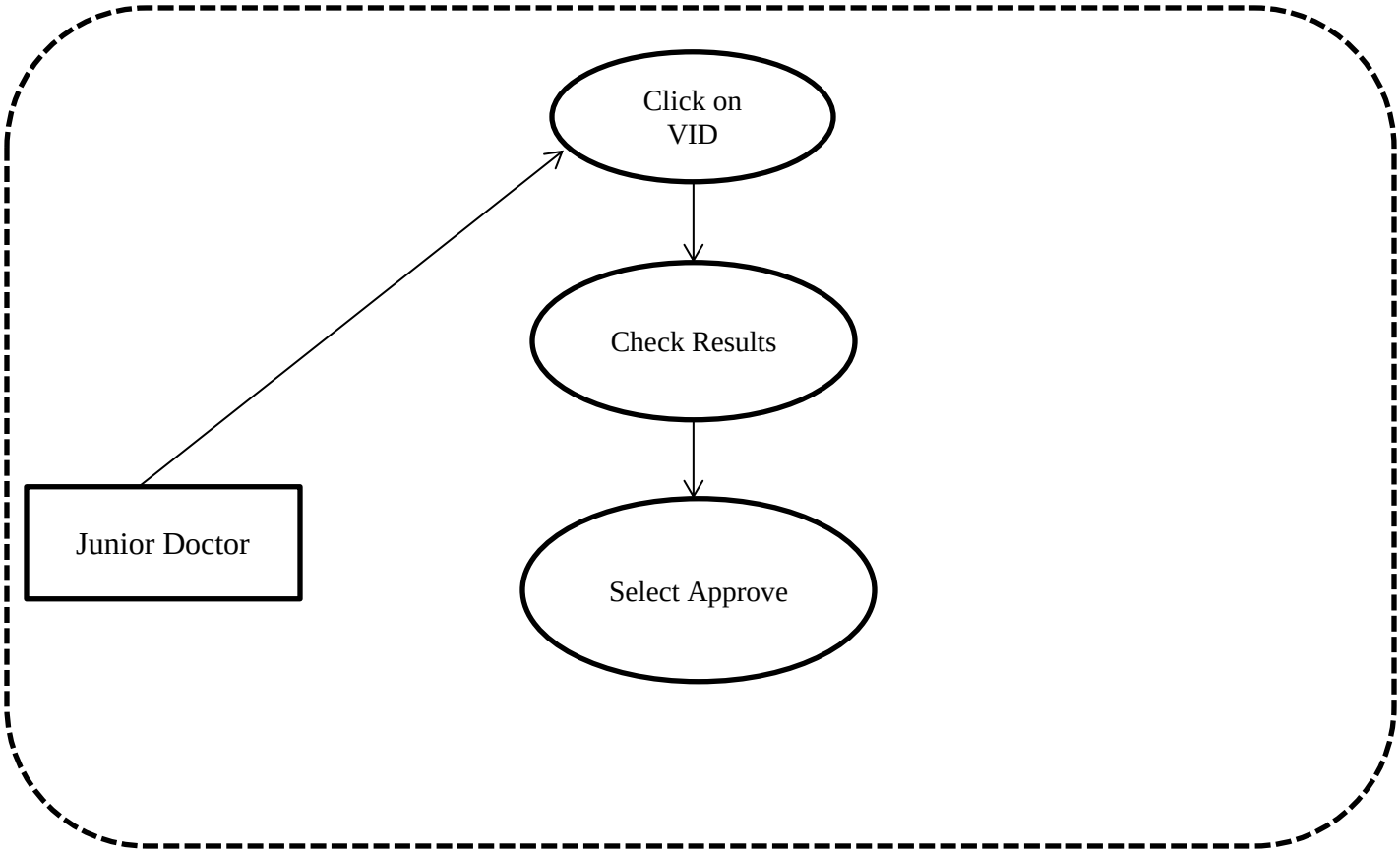


10.7. Junior Doctor approves the result

Use Case No.	10.7
Use Case Name	Junior Doctor approves the result
Basic Flow	• The use case begins when the user (Junior Doctor) validates the result • Click on VID • Check the result • Select approve The use case ends
Alternate Course	• Result partially approve • Sample Re run
Pre-condition	• System with internet connection should be available
Post condition	• Junior Doctor approves the result

Use Case No. 10.7

Use Case Name: Junior Doctor approves the result

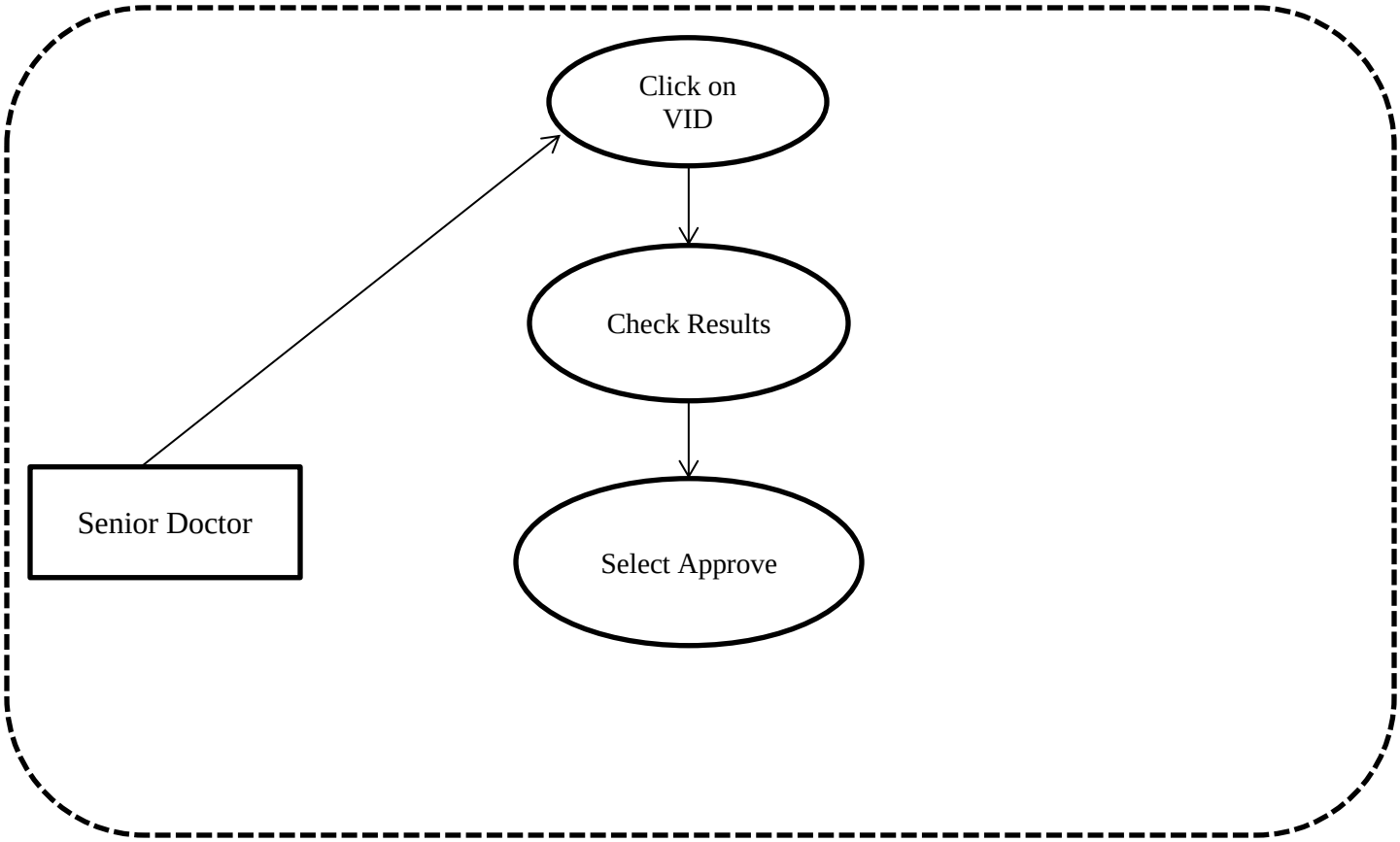


10.8. Senior Doctor approves the result

Use Case No.	10.8
Use Case Name	Senior Doctor approves the result
Basic Flow	• The use case begins when the user (Senior Doctor) validates the result • Click on VID • Check the result • Select approve The use case ends
Alternate Course	• Result partially approve • Sample Re run
Pre-condition	• System with internet connection should be available
Post condition	• Senior Doctor approves the result

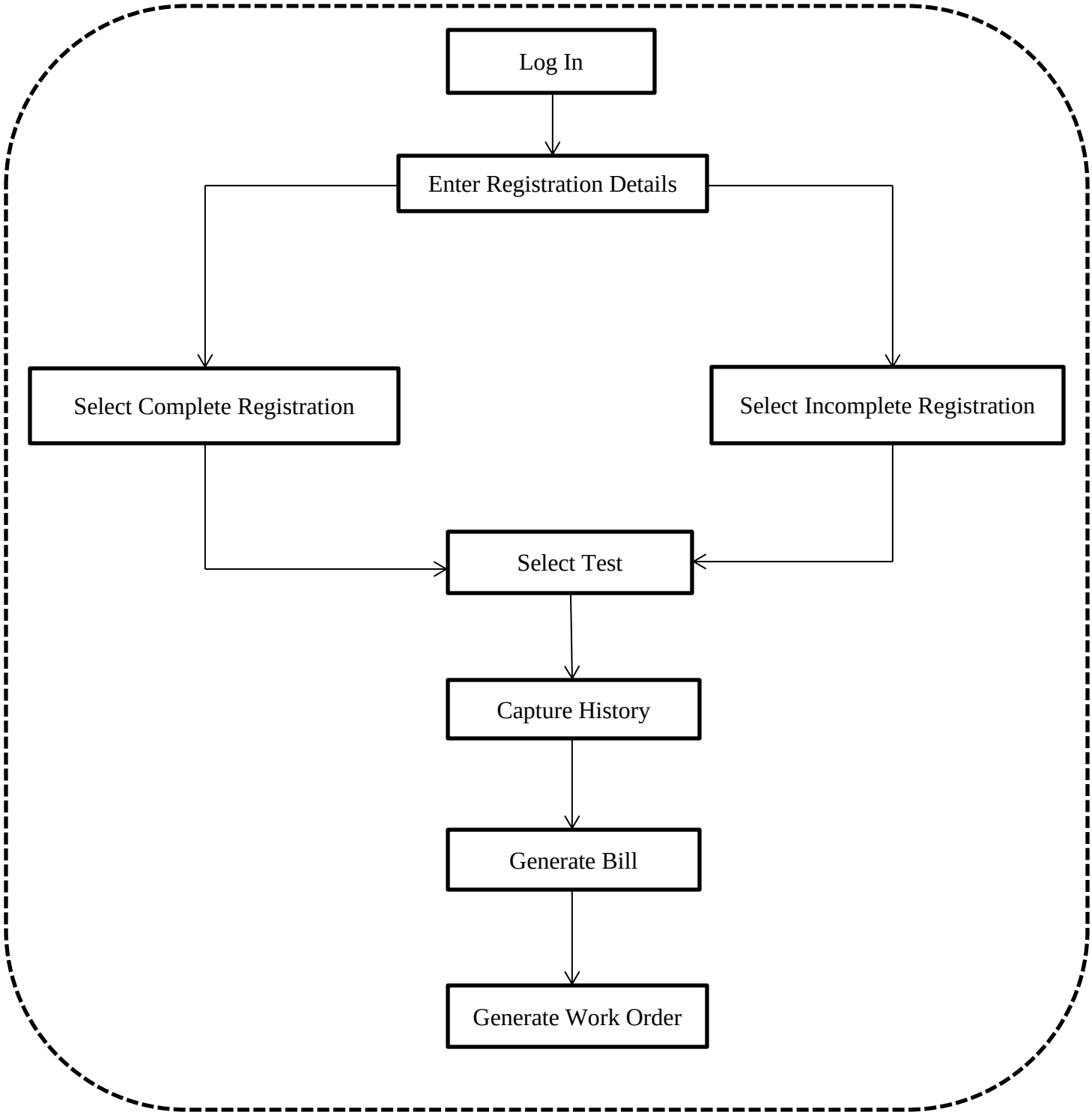
Use Case No. 10.8

Use Case Name: Senior Doctor approves the result

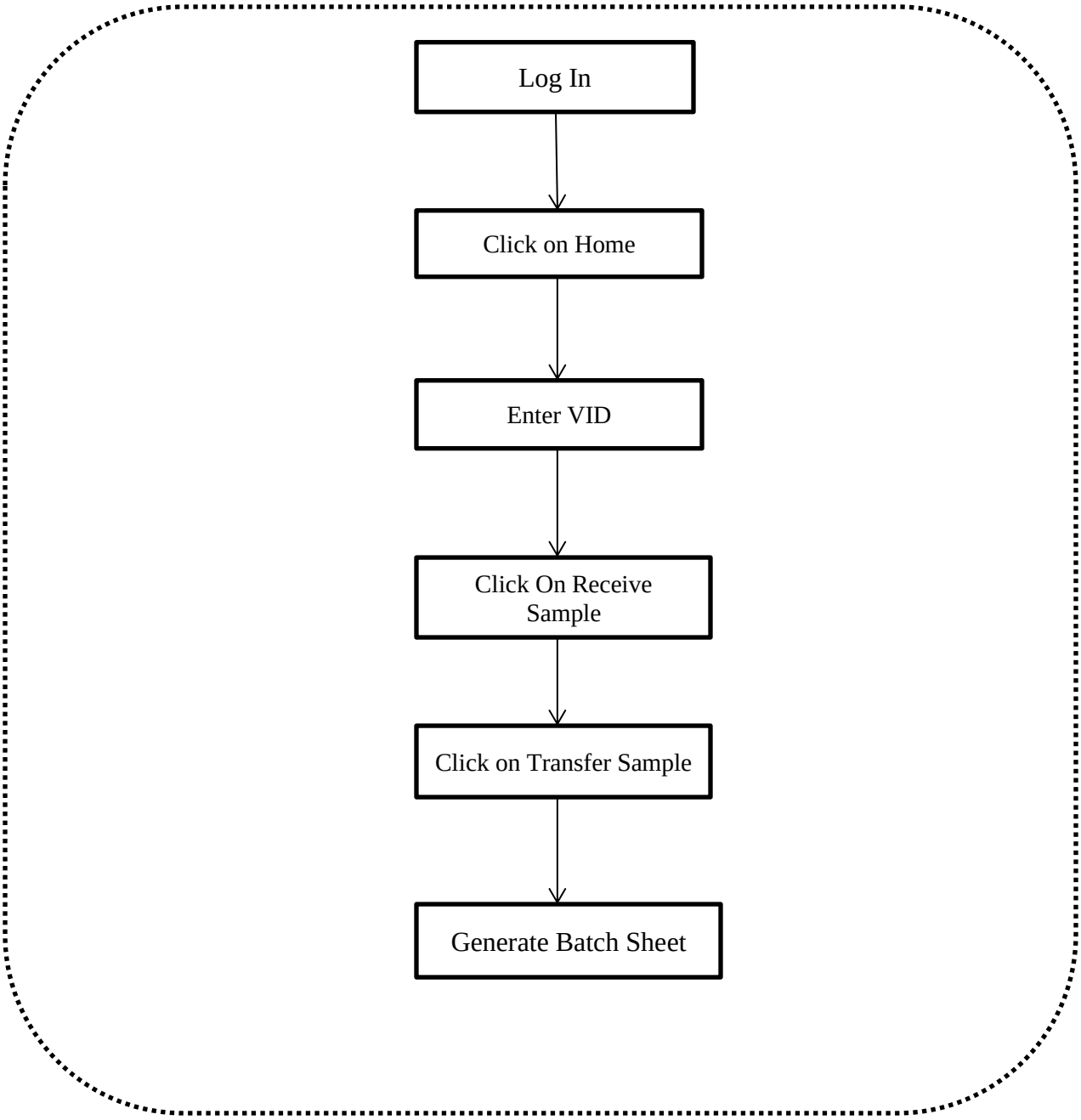


11 Activity Diagram

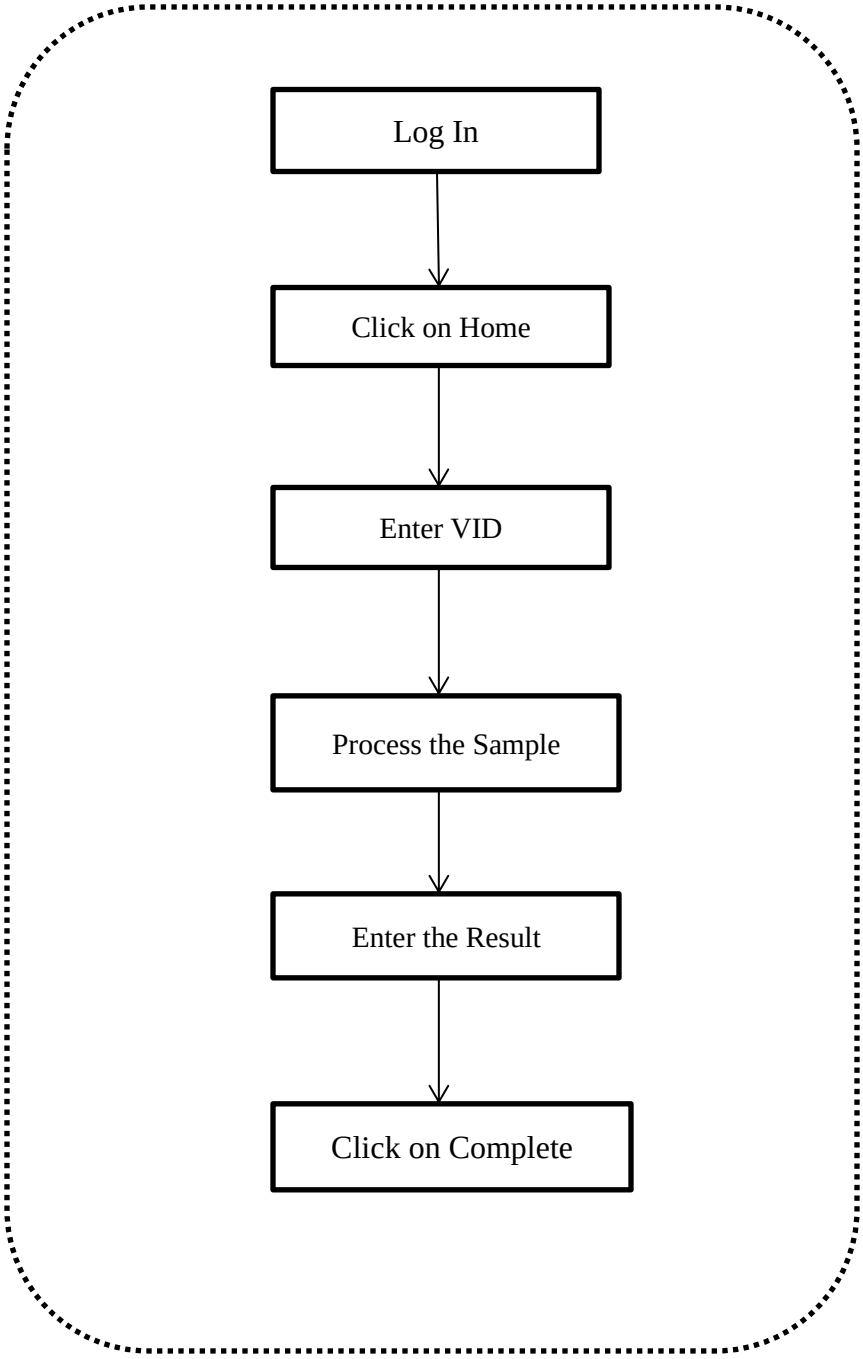
11.A Activity diagram for registration



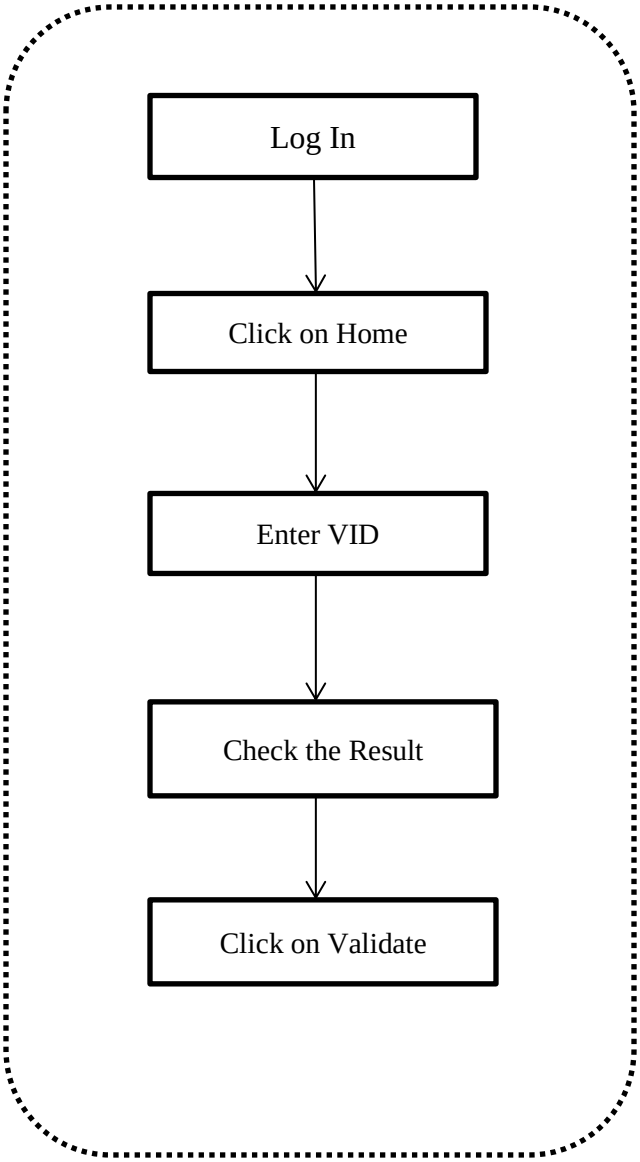
11.B Activity Diagram for Sample Receive



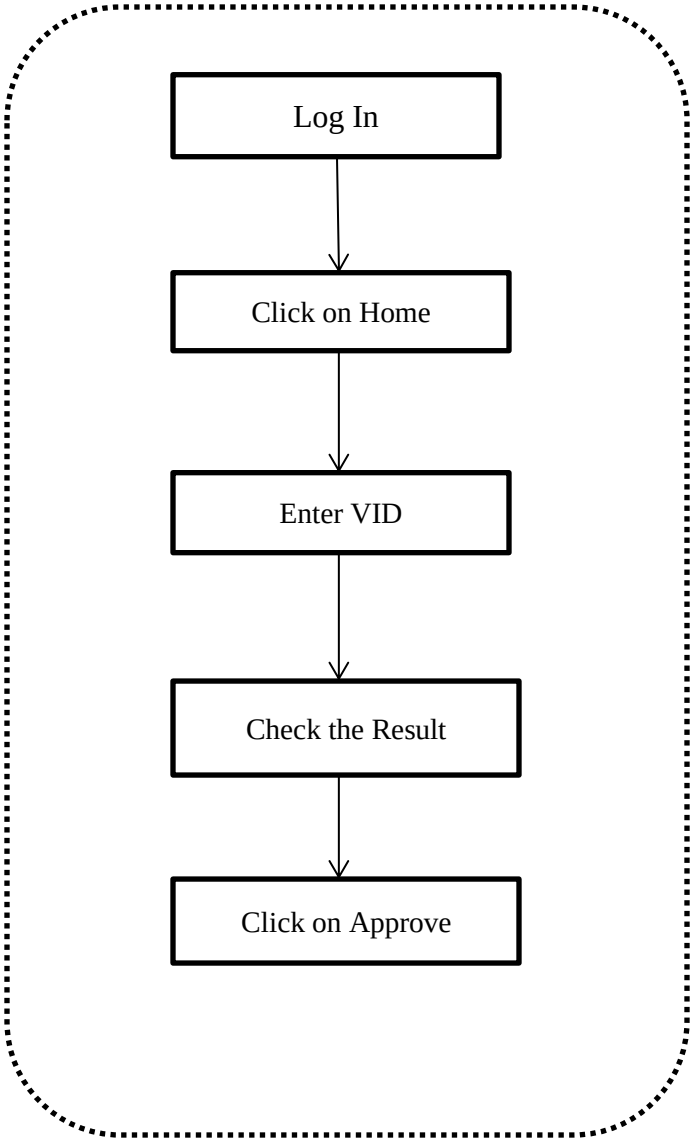
11.C Activity Diagram For Result Entry



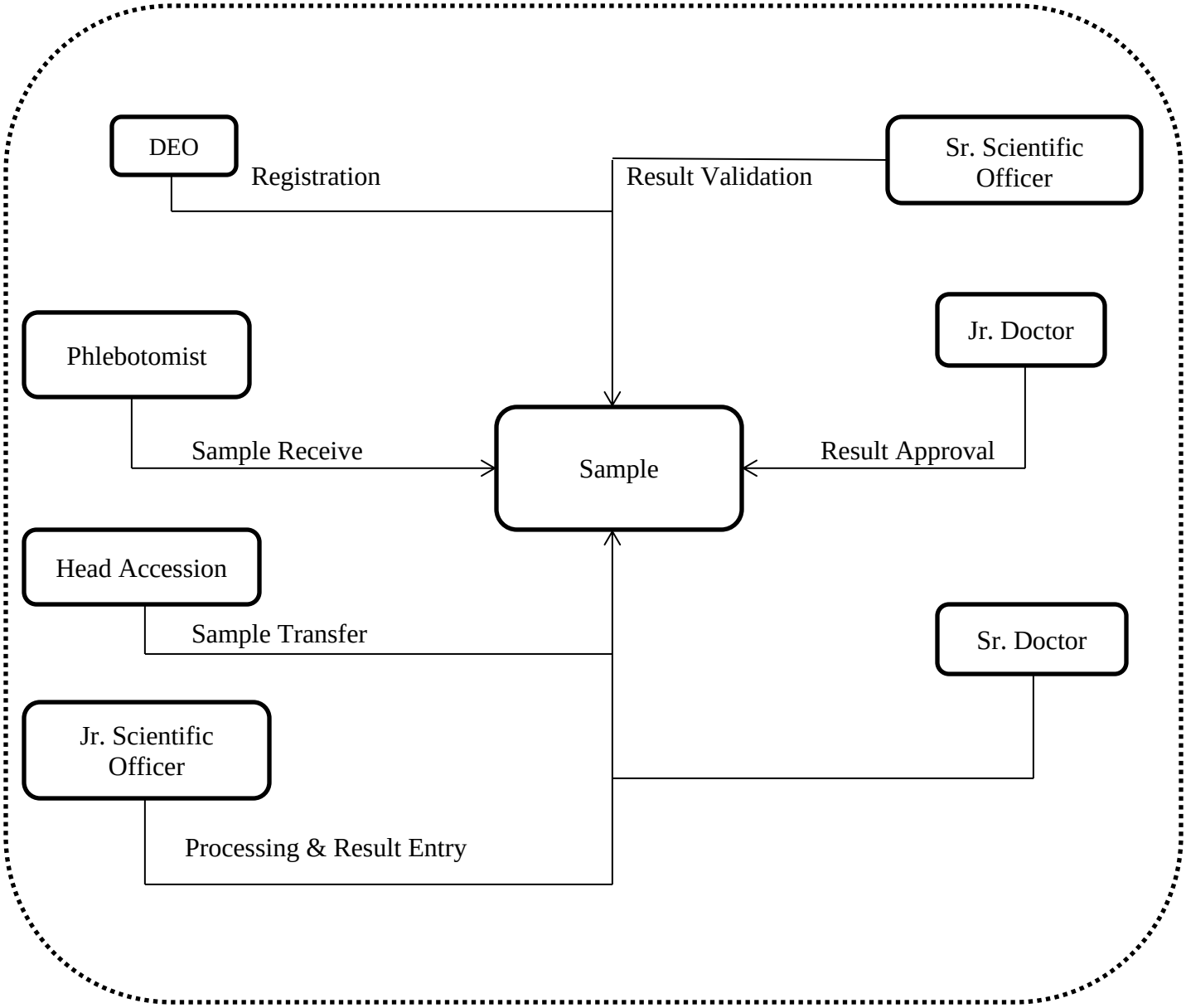
11.D Activity Diagram for Validation



11.E Activity Diagram for Approval



12. DATA FLOW DIAGRAM



13. LIMITATIONS

- End-users always keep on changing the requirements.
- Data was not accurately mapped in few tests
- Metropolis is using Metro lab software more than 10 years so users are reluctant to use ATTUNE LIMS
- Metropolis has many locations with many employees which makes it difficult to co-relate
- ATTUNE LIMS is internet based so whenever internet connection is slow big loss it is difficult for the users to operate LIMS.
- Communication with the client was a big issue.

14. RECOMMENDATIONS

- The data should be mapped accurately using the forms in use before creation of master data.
- They should be verified with the end users
- Data dictionary should be available
- Requirements should be gathered with respect to report formats, verified and closed.
- End users should be provided training to enter the data. Regular feedback & follow up training should be given
- User manual should be provide to end users for reference.

15. CONCLUSION

Implementing a LIMS is an expensive process, one which must be improved considerably if it is to become more widely available. There exist many technologies of which to take advantage is a big question. However, there are very prominent risks involved in the implementation of a LIMS. A high failure rate can deter many laboratories from attempting such a project. There are various ways to reduce this risk of failure but none of them provide a total, ideal solution. The guidelines for successfully implementing a LIMS are useful but are by no means complete. What may work for one business may be totally unsuitable for another. However, a LIMS can work, they have been shown to work and they have been shown to be very profitable when employed correctly. It is necessary that, before committing to any particular LIMS, the consumer sits down and reads all the facts. They should be aware of all the possible pitfalls (those already identified) and how to avoid them. A LIMS is a subject that, if tackled correctly, can yield astonishing results.

16. BIBLIOGRAPHY

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