DISSERTATION

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IMPLEMENTATION OF LIMS IN METROPOLIS HEALTHCARE

BY

DR. Samprada Bhatkar

UNDER THE GUIDANCE OF

DR. Anandhi Ramachandran

Post Graduate Diploma in Hospital and Health Management

(2012-2014)

IIHMR DELHI

International Institute of Health Management Research

New Delhi

2014

New Delhi

The certificate is awarded to

Dr. Samprada Prashant Bhatkar

In recognition of having successfully completed her
Internship in the Implementation team
And has successfully completed her Project on

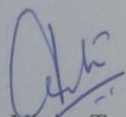### Implementation of LIMS in Metropolis Healthcare, Mumbai

From

3rd February 2014-3rd May 2013

In **ATTUNE Technologies**

She comes across as a committed, sincere & diligent
Person who has a strong drive & zeal for learning

We wish her all the best for future endeavors

Vinita Torka
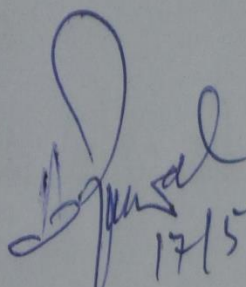**Implantation Manager**
ATTUNE technologies

Dr. Atul Kothadiya
Project In charge , Mumbai
ATTUNE technologies
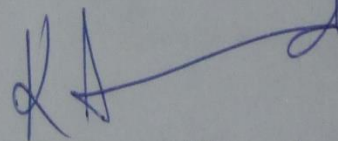
TO WHOMSOEVER MAY CONCERN

This is to certify that **Dr.Samprada P. Bhatkar** 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** from 3/02/2014 to 3/05/2014

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

The Internship is in fulfillment of the course requirements. I
wish her all success in all her future endeavors.

17/5/2014

Dr. A.K. Agarwal

Dean, Academics and Student Affairs
IHMR, New Delhi

Dr. Anandhi Ramachan

Asst.Professor
IIHMR, New Delhi

Certificate Of Approval

The following dissertation titled **"IMPLEMENTATION OF LIMS IN METROPOLIS HEALTHCARE"** at **"ATTUNE TECHNOLOGIES"** 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.

Name   Signature

Dr. Anandhi Ramachandar

DR. ABHIJIT CHAUKRABURTY
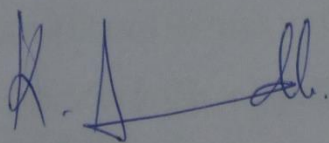
Certificate from Dissertation Advisory Committee

This is to certify that **Dr. Samprada Prashant Bhatkar** a graduate student of the **Post-Graduate Diploma in Health and Hospital Management** has worked under our guidance and supervision. She is submitting this dissertation titled "IMPLEMENTATION **OF LIMS IN METROPOLIS HEALTHCARE**" at "ATTUNE TECHNOLOGIES" in partial fulfillment of the requirements for the award of the **Post- Graduate Diploma in Health and Hospital Management.**
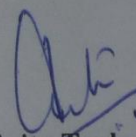
This dissertation has the requisite standard and to the best of our knowledge no part of it has been reproduced from any other dissertation, monograph, report or book.

Dr.Anandhi Ramachandran

Assistant Professors

IIHMR,Delhi

Vinita Torka

Implementation Manager

ATTUNE Technologies

INTERNATIONAL INSTITUTE OF HEALTH MANAGEMENT RESEARCH, NEW DELHI

CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled **IMPLEMENTATION OF LIMS IN METROPOLIS HEALTHCARE** and submitted by **Dr. Samprada Prashant Bhatkar** Enrollment No **PG/12/077** under the supervision of **Dr.Anandhi Ramachandran** for award of Postgraduate Diploma in Hospital and Health Management of the Institute carried out during the period from **3/02/2014** to **3/05/2014** 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.

S.P.Bhatkar

Signature
(Dr. Samprada P. Bhtakar)

FEEDBACK FORM

Name of the Student: Dr. Samprada Prahsnat Bhatkarp

Dissertation Organization: ATTUNE Technologies

Area of Dissertation: Implementation and Support

Attendance: 90 %

Objectives achieved:
- Requirement gathering and addressing issues faced by users
- Implementation of New departments
- Support to already LIVE departments
- Training programs for end users
- Monitor user's issues through various methods
- Increase awareness of software in users through various methods.
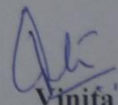
Deliverables:
- User training for registration and accession
- Master Data for IFA and Clinical pathology and serology department
- Bug trackers issues

Strengths:
- Hard working
- Team Work
- Highly motivated and enthusiastic
- Multi tasking

Suggestions for Improvement:
- Should do follow-up till the completion of work
- Learn thoroughly about the system

Vinita Torka
Implementation Manager
ATTUNE Technologies

Date: 6 th May 2014
Place: Mumbai

ACKNOWLEDGEMENT

I express my gratitude towards **God** and **my Parents** who supported me always and motivated me.

I am extremely thankful to A**TTUNE Technology** who gave me opportunity to work with them on site at Metropolis Healthcare sharing generously their knowledge and time, which inspired me to do my best during my summer training.

I express gratitude to **Mr. Atul kothadiya(** Project Manager ,ATTUNE Mumbai) for providing support

I am immensely thankful to Miss Vinita Torka (Implementation Manager at ATTUNE) for guidance for the learning and for directing the thoughts, goals and objectives towards the attitude that drives to achieve learning and other aspects that one as novice needs to be acquainted with.

I express my heartfelt Thanks to my mentor Dr **.Anandhi Ramachandran** (Asso. Professor at IIHMR) for their guidance and constant supervision as well as for providing necessary information regarding the project.

.My sincere thanks **to Metropolis Healthcare** to help me in my learning work and project

.

Dr.Samprada Bhatkar (P.T.)

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List of Abbreviations

Sr.No		Abbreviations
1	JSO	Junior scientific officer
2	SSO	Senior scientific officer
3	JD	Junior Doctor
5	SD	Senior Doctor

Problem statement

Up until the late 1970s, the management of laboratory samples and the associated analysis and reporting were time-consuming manual processes often riddled with transcription errors. This gave some organizations impetus to streamline the collection of data and how it was reported. Custom in-house solutions were developed by a few individual laboratories, while some enterprising entities at the same time sought to develop a more commercial reporting solution in the form of special instrument-based systems. Carrying those instruments was very coastly.Report maintaining, Quality maintaining all these was a hectic jobs for Labs

So In 1982 the first generation of LIMS was introduced in the form of a single centralized minicomputer, which offered laboratories the first opportunity to utilize automated reporting tools. As the interest in these early LIMS grew, industry leaders like Gerst Gibbon of the Federal Energy Technology Centre in Pittsburgh began planting the seeds through LIMS-related conferences. By 1988 the second-generation commercial offerings were tapping into relational databases to expand LIMS into more application-specific territory, and International LIMS Conferences were in full swing. As personal computers became more powerful and prominent, a third generation of LIMS emerged in the early 1990s. These new LIMS took advantage of the developing client/server architecture, allowing laboratories to implement better data processing and exchanges.

By 1995 the client/server tools had developed to the point of allowing processing of data anywhere on the network. Web-enabled LIMS were introduced the following year, enabling researchers to extend operations outside the confines of the laboratory. From 1996 to 2002 additional functionality was included in LIMS, from wireless networking capabilities and dereferencing of samples, to the adoption of XML standards and the development of Internet purchasing

As of 2012, some LIMS have added additional characteristics that continue to shape how a LIMS is defined. Examples include the addition of clinical functionality, electronic laboratory notebook (ELN) functionality, as well a rise in the software as a service (SaaS) distribution model

Metropolis Health Services has grown by leaps and bounds. It is a spectacular success story marked by impressive milestones.

They started in **1981**as first laboratories to offer comprehensive range of immunoassays by RIA. and today it is the best healthcare Lab in Asia and Pan Asia. Today they have over 10 million tests a year, catering to more than 10,000 Laboratories, Hospitals, Nursing homes and 20,000 Consultants; and with 31 years of experience .Marinating these in this competitive world with Quality assurance maintenance is very difficult. The daily business of any corporation has a direct or indirect impact on a wide spectrum of society. This brings in its wake an enormous responsibility of conducting business in an ethical manner.

For maintaining all this metropolis needs software-based laboratory and information management system that offers a set of key features that support a modern laboratory's operations which will maintain MIS , Quality , saves time of both Technician and doctors and which will ease patient and can incorporate modern techniques

Attune is the consultancy which work on LAIMS and HMIS.LIMS implementation project is taken by ATTUNE

2 .SCOPE OF PROJECT:

A LIMS provides benefits for many of the users of 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. The improvement of business efficiency.

Patient can be registered easily and details are maintained for long time. Sample transferring receiving made easy .Processing sample is the most time consuming process, Interfacing and annual processing will be easy using ATTUNE LIMS.result are gone under 4 levels for rechecking which will ensure accurate results and quality.Immdiete report via mail will help patient for diagnosis of disease.

Patient registration

↓

Sample collection at phlebotomy role

↓

Sample receives at Accession role and work order

↓

Sample processing and interfacing of the sample

↓

Result entry ant junior scientific office role

↓

Result validation at senior scientific officer role

↓

Result approval at junior doctor role

↓

Result rechecking at senior doctor role

↓

Auto email sent to patient within 20 min after approval

↓

Reports are either hand delivered or courier to patient

3 . Feasibility:

Attune has made a web based software which will help for quick registration quick processing rechecking results. Metro polis has two types of client B2B and B2C , Process of B2C is in 7 steps while process of B2B is in 6 steps

Patient is registered and VID and PID is developed . Sample is collected from the patient and barcode which has the test name and Barcode number and VID is generated and is attached to dample tubes or container. Sample is received in accession department and work orders are made for processing and sample are sent o department by vacuumed pipes in containers. In the departments Sample are received and proceeded either by interfacing or manually. Processed results are entered .Work list are taken in department so that no sample is missed. According to wordlists samples are processed and results are entered for manual test and for interfacble test values are directly pushed from machine to the result parameters report is completed and sent for validation. At validation level report values are check and report is validated and sent for approval.SR. and Jr.Doctor approves the report and auto generated email is sent to patient .

4 .Change management:

Change management is an approach to transitioning individuals, teams, and organizations to a desired future state In a project management context, change management may refer to a project management process wherein changes to the scope of a project are formally introduced and approved.

Metropolis started in 1981 in Mumbai and slowly ;they have increased their branches all over India and pan India

Our network of more than 105 state-of-art-laboratories across India, UAE, Sri Lanka, South Africa, Bangladesh etc..with over 700 collection centers further demonstrate how committed we are to delivering accurate and timely results across the 4500 plus routine, specialized and highly specialized investigations we offer - investigations that use over 100 different technologies including Biochip and DNA sequencing. Innovations like Home Health Services enable us to reach you so that going for a check up is no longer an inconvenience

At Metropolis, we support the global Endeavour to fight disease by incorporating cutting-edge technology and practices that work hand-in-glove with our awareness drives and health check up camps. Metropolis's capability to carry out health checkups and testing across large geographies ensures that companies can be assured of consistent results and our unique loyalty programmers provides you with even more reasons to get health check ups done. After all in the battle against disease, diagnosis is the first step.

Our services include Clinical Laboratory Medicine, Hospital Laboratory Management, Central Laboratory Services for Clinical Trials, Home Health Services and Preventive Health Check ups.

Today metropolis has n number of satisfied customers and clients.

In this competitive work keeping clients customers happy with service, maintaining quality in the work is very important task.

Metropolis Health Services has made its commitment to quality very basic, tangible and measurable. Customer satisfaction is one of parameters by which we judge our efforts in this direction. Over 12 million tests per year at 65 locations show that, when it comes to quality commitment, we walk the talk.2500 employees are working to implement and utilize the latest

proven systems for continuous improvement. They know quality means attaining a level of performance and attitude that makes Metropolis the natural choice for people in need of excellent diagnostic services.

They were using Metrolab software which was Microsoft based. This software was efficient in all processes. Like Registration , sample processing report generation. This software had some disadvantages like it was not a web based slow and New technology like ICD 10 codes , Report auto emailing and transparency un the work was not available. Most of the work in the metro lab was paper base. Metro lab has undergone NABL and CAP accreditation.

Quality is the new aspect which has loads of importance

Quality Policy

1. Metropolis laboratory, all the time will work towards a common goal of total customer satisfaction by providing cost effective pathological testing services with precise investigation, quality, speed, accuracy, safety, integrity and courtesy. Metropolis assures services in compliance with ISO 15189:2007 and adhering to National and International Standards applicable to Clinical Testing Laboratory and Good Laboratory Practices (GLP).

Quality Objectives

1. Maintaining high standards of practice through sound judgment in establishing, performing and evaluating laboratory tests
2. Continuous monitoring of positive and negative feedback received from the customer. Total customer satisfaction is ensured by providing customized, cost-effective, accurate and timely diagnostic services
3. Creating awareness among all employees, through training and implementation of defined quality system procedures
4. Continuous improvement of laboratory performance by monitoring proficiency testing results, training and up-gradation of skills through CME programmers, second and third party audits and benchmarking

5. Implementing a quality system in compliance ISO 15189:2007.

QUALITY CONTROL

The Quality Control program for each test method is evaluated so that:

Manufacturers written instructions for operation are followed and recommendations for maintenance are implemented and documented.

1. A procedure manual is readily available to the laboratory staff at all times.
2. QC samples are analyzed as specified in the procedure manual and results are documented each day of testing.
3. Testing personnel have taken appropriate corrective action when calibration and control values are out of the acceptable range.
4. Patient results are not reported unless QC results are within acceptable limits.

Department	Quality control levels run
Hematology	3 levels (BIORAD) daily
Biochemistry	2 levels (BIORAD) daily
ELISA	Positive and negative control with every run
Immunoassay	3 levels (BIORAD) daily
Microbiology	1. Positive control with Standard strains for media performance check and negative control for media sterility with every batch 2. Autoclave sterility indicators with every load 3. Temperature checking and recording Of refrigerator and incubator. 4. QC check on staining procedure

5. In cases where control is out of range, recalibration is done and the quality control sera are retested. If control is then found to be normal, the patients specimens are tested.
6. However, if it still remains out of range, calibration and quality control is repeated with fresh calibrators and quality control sera vial. But when the case persists, a biomedical engineer is called for trouble-shooting.
7. Documentation of our corrective action is done whenever values are not within range.
8. SD and CV%, calculated monthly after plotting Levy Jennings chart, must meet established performance limits.

For maintaining quality , patient satisfaction and modern techniques they needs LIMS which will be web based and can solve all these problems.

The LIMS is an evolving concept, with new features and functionality being added often. As laboratory demands change and technological progress continues, the functions of a LIMS will likely also change. Despite these changes, a LIMS tends to have a base set of functionality that defines it. That functionality can roughly be divided into six laboratory processing phases, with numerous software functions falling under each

- Registration
- Sample receiving and transferring from ther location
- Sample receiving at processing location
- Sample processing and result entry
- Result validation and approval
- Reports dispatch

There are several pieces of core functionality associated with these laboratory processing phases that tend to appear in most LIMS:

For metropolis Implementing ATTUNE LIMS was a process change. The whole process of registration and sample processing was changed. New ATTUNE LIMES was web enabled so

that patient can be registered from remote location. The complete new process of registration sample processing and report dispatch was difficult for employees.

LIMS had Data entry operator for registration; For sample receiver and transfer Phlebotomist which avoided confusion and reduced paper work. Head accession role for sample receive at processing location and generating work order for Jr. Scientific officer role. Jr. Scientific officer for processing and Sr. Scientific officer role for validation and Jr.Doctor and Sr. Doctor role for approval Dispatch controller for report dispatch.

There other many roles which are available in LIMs like accounts CT

All these things Process change management for which they hired many DEO at different locations

Metrolab was web based application while ATTUNE LIMS is web enabled application.

Computers with 4 GB RAM and minimum 15 Mbps speed ,They required High speed LAN

5 .Activity allocation :

A PERT chart is a graphic representation of a project's schedule, showing the sequence of tasks, which tasks can be performed simultaneously, and the critical path of tasks that must be completed on time in order for the project to meet its completion deadline. The chart can be constructed with a variety of attributes, such as earliest and latest start dates for each task, earliest and latest finish dates for each task, and slack time between tasks. A PERT chart can document an entire project or a key phase of a project. The chart allows a team to avoid unrealistic timetables and schedule expectations, to help identify and shorten tasks that are bottlenecks, and to focus attention on most critical tasks.

Duration of entire project is more than 2 years and it is till going on sp exact dates are not available due to confidentiality

Following is the rough idea of the project

5.1 Go live department

```
┌──────────────────────┐      ┌──────────────────────┐
│ Requirement          │  ┌──▶│ Assembling team      │
│ gathering            │──┤   └──────────────────────┘
│        0 day         │  │
├──────────────────────┤  │   ┌──────────────────────┐
│ start date-end date  │──┼──▶│ Sending team on      │
└──────────────────────┘  │   │ site for project     │
                          │   └──────────────────────┘
                          │
                          │   ┌──────────────────────┐
                          └──▶│ Infrastructure       │
                              │ Management           │
                              └──────────────────────┘
```

| Go live department for Microbiology department and all sections under Microbiology | → | Go live department for Surgical Pathology department and all sections under surgical pathology | → | Go live department for Genetics department and all sections under Genetics |

| Go live department for Research and development department | → | Go live department for clinical chemistry department and all sections under Clinical chemistry | → | Go live department for Clinical trials | → | Go live department for Commercials | → | Go live department for veterinary |

| | ~1095 days |
| | JUN14 |

5.2 Project Plan for every department

```
Master data of          Report format         Parallel run for       User training of       Go-live for           Support for Micro bio
microbiology       →    and requirement   →   Micro bio          →   micro dept         →   Micro bio         →
                        gathering for
                        Micro bio
                             ↓
                        Master data of        Report format         Parallel run for       User training         Go-Live
                        Surgical          →   and requirement   →   Surgical Path      →   for Surgical      →   for
                        Pathology             gathering for                                path Dept             Surgical
                                              Surgical Path
                                                   ↓
Support for Surgical path and micro bio           Master data of        Report format
                                                  Genetics          →   and requirement
                                                                        gathering for
Parallel run for       User training         Go live of            Support for Genetics and     Genetics
Genetics           →   for Genetics      →   Genetics          →   already LIVE dept
                       Dept
                                                                                             →
Master Data of         Report format         Parallel run for       User training         Go-Live for R n      Support for R n
R n D Dept         →   and requirement   →   R n D dept         →   for R n D dept     →   D Dept           →   D and already
                       gathering for R                                                                          Live Dept
                       n D Dept
                            ↓                                                                                        ↓
                       Master data of        Report format and     Parallel run for       User training         Go-Live
                       Clinical          →   requirement       →   clinical           →   for Clinical      →   for
                       chemistry             gathering for          Chemistry             chemistry             Clinical
                                             Clinical chemistry                                                 Chemist
                                                  ↓
                                             Master data of CT   →  Report format and
                                                                    requirement gathering
                                                                    for CT
```

```
┌──────────────────┐     ┌──────────────────┐     ┌──────────────────┐     ┌──────────────────┐
│ Parallel run For CT│ →  │ User training for │ →  │ GO-Live for CT    │ →  │ Support for CT    │
│                    │    │ CT                │    │                   │    │ and already LIVE  │
└──────────────────┘     └──────────────────┘     └──────────────────┘     └──────────────────┘
```

```
┌──────────────┐   ┌──────────────┐   ┌──────────────┐   ┌──────────────┐   ┌──────────────┐   ┌─────────┐
│ Master data of│ → │ Report format │ → │ Parallel run of│ → │ Sign off of  │ → │ Go live of   │ → │ Support │
│ Commercials  │   │ and          │   │ commercials  │   │ commercials  │   │ Commercials  │   │         │
│              │   │ requirement  │   │              │   │              │   │              │   │         │
│              │   │ gathering of │   │              │   │              │   │              │   │         │
│              │   │ commercials  │   │              │   │              │   │              │   │         │
└──────────────┘   └──────────────┘   └──────────────┘   └──────────────┘   └──────────────┘   └─────────┘
```

```
┌──────────────┐   ┌──────────────┐   ┌──────────────┐
│ Master data of│ → │ Report format │ → │ Parallel run for│
│ veterinary   │   │ and          │   │ Veterinary   │
│              │   │ requirement  │   │              │
│              │   │ gathering of │   │              │
│              │   │ veterinary   │   │              │
└──────────────┘   └──────────────┘   └──────────────┘
```

```
┌──────────────┐   ┌──────────────┐   ┌──────────────┐
│ User training │ → │ GO-Live for  │ → │ Support for  │
│ for veterinary│   │ veterinary   │   │ veterinary and│
│              │   │              │   │ already LIVE dept│
└──────────────┘   └──────────────┘   └──────────────┘
```

6 .Gantt chart

Legend:
- Solution Mapping
- Master Data
- Configuration
- Testing , Support & Internal Acceptance
- User Acceptance Test (UAT)
- User Training
- User Evaluation Test (UET)
- Parallel run
- Go Live

METROPOLIS — LIMS

	MARCH14	APRIL14	MAY14
	F S Su M T W T F S Su M T W T F S Su	M T W T F S Su M T W T F Su M T W T F S Su	M T W T F S Su
	15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31	01 02 03 04 05 06 07 08 09 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30	01 02 03 04
Clinical chemistry			Live
Clinical trials		Buffer / Buffer	Live
Commercials		Buffer / Buffer / Buffer	Live
Veternary		Buffer / Buffer	Live

7 .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; and with 31 years of experience delivering accurate reports, Metropolis has also earned the reputation of being India's only multinational chain of diagnostic centers 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) reiterate that we meet stringent national and international quality requirements - imperative in a vital service sector like healthcare.

Our network of more than 105 state-of-art-laboratories across India, UAE, Sri Lanka, South Africa, Bangladesh etc..with over 700 collection centers further demonstrate how committed we are to delivering accurate and timely results across the 4500 plus routine, specialized and highly specialized investigations we offer - investigations that use over 100 different technologies including Biochip and DNA sequencing. Innovations like Home Health Services enable us to reach you so that going for a checkup is no longer an inconvenience.

At Metropolis, we support the global Endeavour to fight disease by incorporating cutting-edge technology and practices that work hand-in-glove with our awareness drives and health check up camps. Metropolis's capability to carry out health checkups and testing across large geographies ensures that companies can be assured of consistent results and our unique loyalty programmers provides you with even more reasons to get health checkups done. After all in the battle against disease, diagnosis is the first step.

Our 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 Metrolab everywhere but that Metrolab was not at all connected with each other so for the connectivity propose they need to use paper and lots of paper work was involved. because main processing location was in Vidyavihar and samples need to transfer to Vidyavihar for processing but without paper work it was not one so with every sample they need to send a paper mentioning about processing location TAT.

Metrolab was web enabled software so was only available in metropolis systems so it was difficult to operate from remote location.

Due to Loads of paper work quality was not maintained and many mistakes were happening. Metropolis is expanding their locations but due to this they are unable to do, Samples coming from far locations like Jabalpur, Ranchi etc, Some times they missed the TAT due to this confusion. Biggest problem was with authorization of the report. Metropolis has 6 different departments having more than 35 doctors who are head of that department. reports which was validated from Sr.Scientific officer used to come to all doctors log in. So every doctor could see all department report but this leads to confusion and mistakes. Sometimes doctor used to approve different departments. For example MD .Micro (Head of department) used to approve genetics department report. So patient used to get faulty report .where microbio report has signature of MD.Genetics.this was leading confusion

To overcome these situation they have decided to tale ATTUNE LIMS. Where ATTUNE has segregated all location as Org and locations. places which has different locations are named as org. Under every org places which has similar work flow was named as location. For example Vidyavihar is a processing location and it has same work flow like Sion collection centre, J.J collection centre so Vidyavihar is an org where Vidyavihar , Sion ,J.J is a locations. User can select locations under org and can do sample transfer.

In Attune lots of paper work was reduced as user 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 microbio HOD are only mapped with Microbiology department and so with other departments. This solved problem of doctor approving report of different department.

Technician's, senior scientific officers are also mapped with departments so they can have only access to their relevant department.

8 .Use cases :

Stake holders:

1. Data Entry operator (DEO_
2. Phlebotomist
3. Accession
4. Jr.Scientifc officer(JSO)
5. Sr.Scientific Officer (SSO)
6. Jr.Doctor (JD)
7. Sr.Doctor (SD)

8.1 USE CASE description and use case diagram :

Use Case Number	8.1General
Use Case Name	Stakeholders Log in
Description	User wants to enter in to the system
Basic Flow	- The use case begins when the user wants to use the system ATTUNE LIMS. - The user enters his/her ID and password - She/he presses enter. - The user is successfully logged in. The use case ends.
Alternate Course A	- ID & 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 to systems

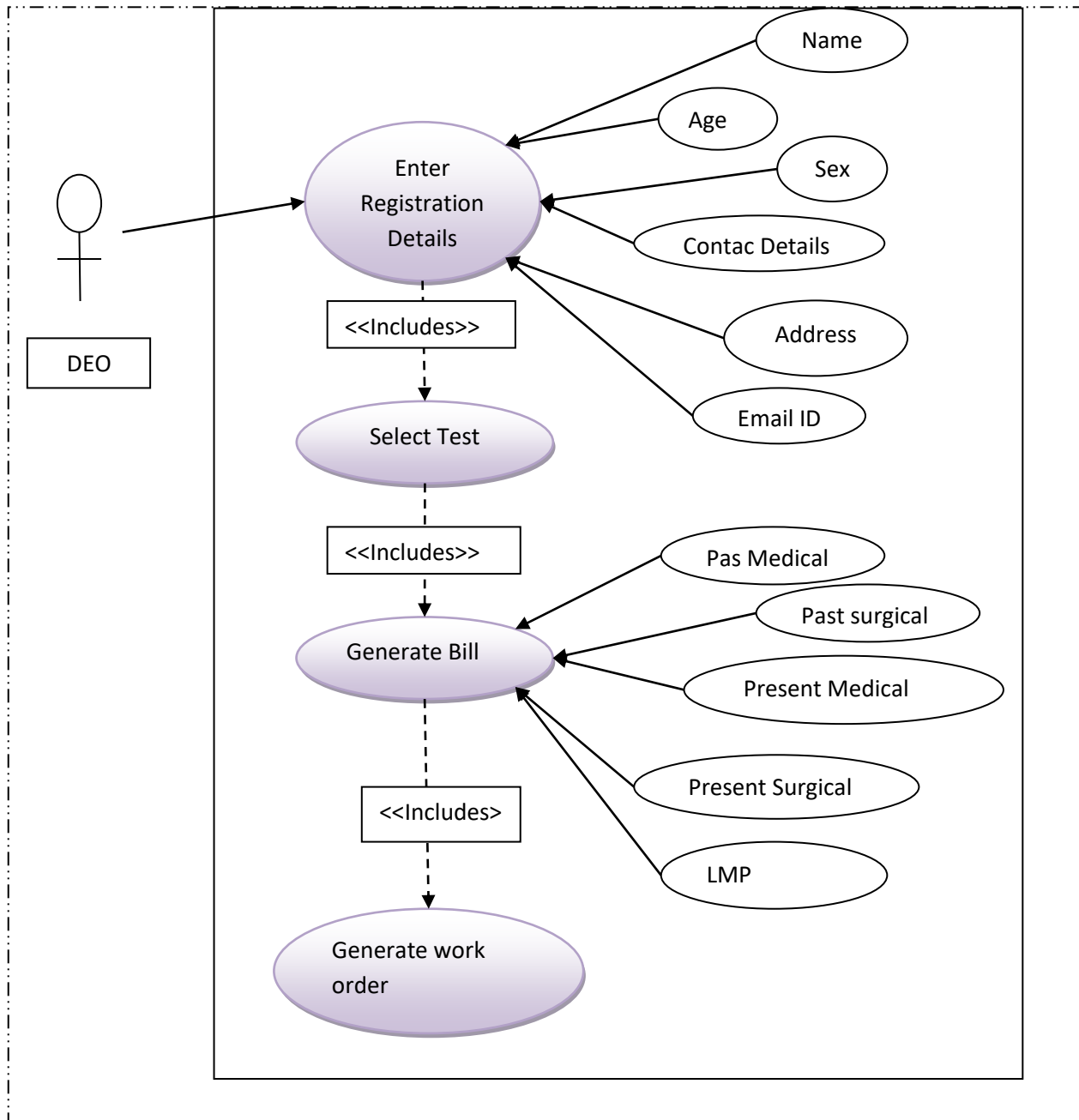8.1Use case number: General

Use case name: Stakeholder log in

LOG IN

<<Includes>>

Enter User name

<<Includes>>

Enter
Password

DEO /
Phlebotomist
/ Accession /
JSO / SSO /JD
/ SD

Administrator

8.2 DEO registers the patient and generate the bill

Use Case Number	8.2
Use Case Name	DEO registers the patient and generate the bill
Description	DEO wants to registers the patient and generate the bill
Basic Flow	• The use case begins when the user wants registers the patient and generate the bill • Enters registration details of the patient • Select the test. • Select discount if applicable • Generates bill • Generate work order The use case ends.
Alternate Course	• DEO do no 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 generate the bill

Use case number: 8.2.

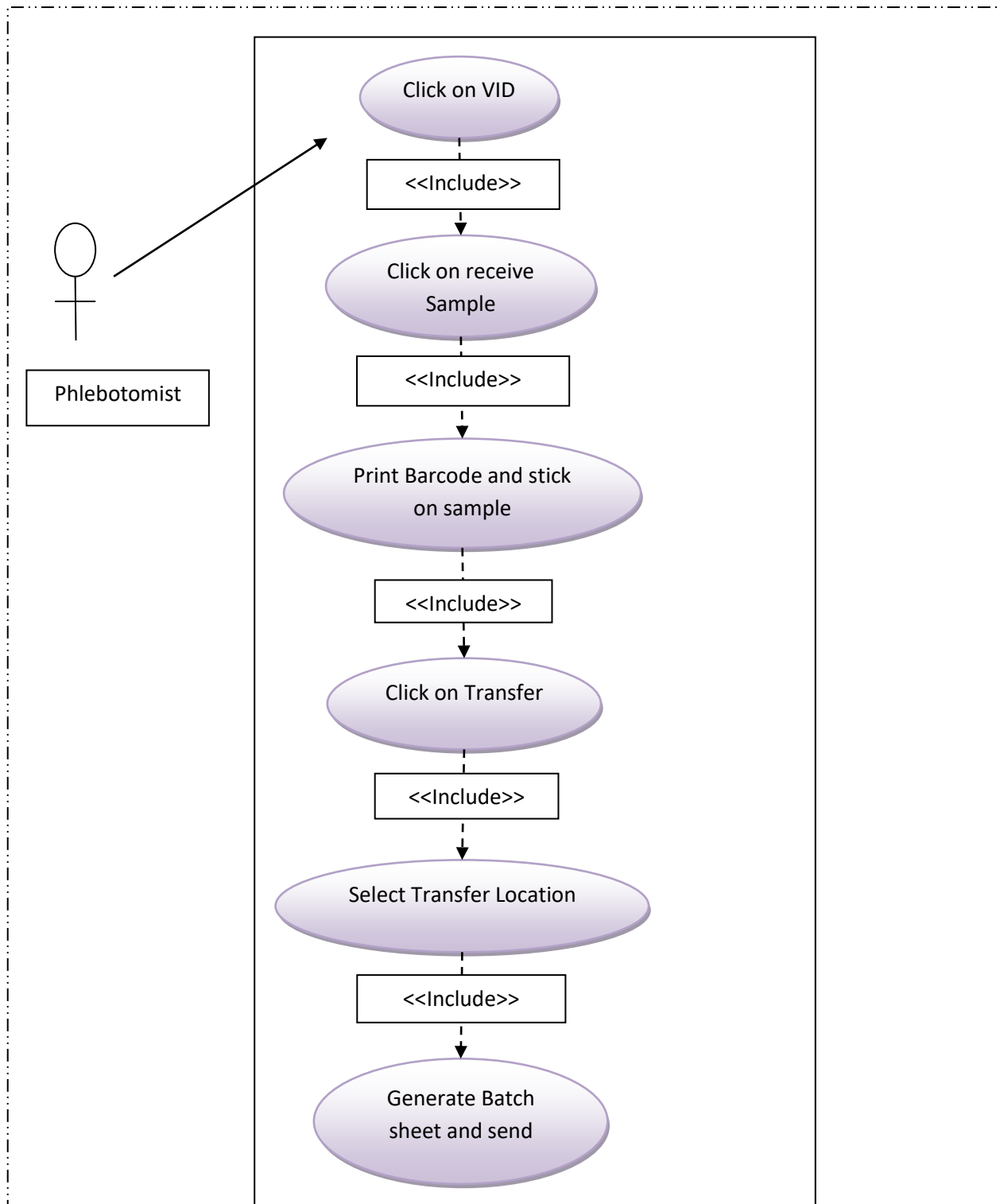Use case name: DEO registers the patient and generate the bill

8.3 Phlebotomist receives the sample and transfer it to processing location

Use Case Number	8.3
Use Case Name	Phlebotomist receives the sample and transfer it to processing location
Description	Phlebotomist receives the sample and transfer it to processing location
Basic Flow	- The use case begins when the user wants Phlebotomist receives the sample and transfer it to processing location - Click on VID - Generate bar code - Click on receive sample - 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 is 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 transfer it to processing location

Use case number: 8.3

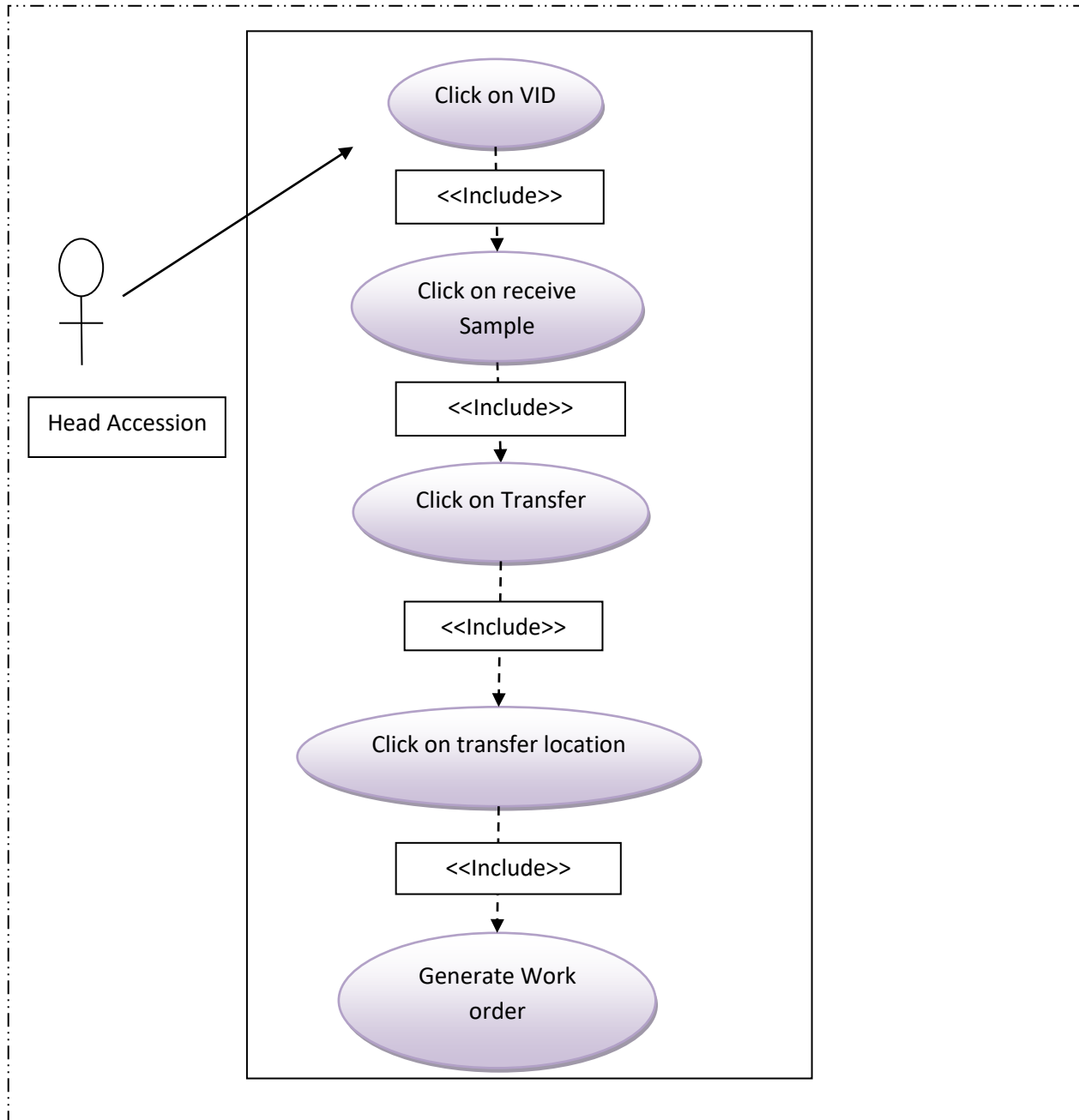Use case name: Phlebotomist receives the sample and transfer it to processing location

Click on VID

<<Include>>

Click on receive Sample

<<Include>>

Print Barcode and stick on sample

<<Include>>

Click on Transfer

<<Include>>

Select Transfer Location

<<Include>>

Generate Batch sheet and send

Phlebotomist

8.4 Head Accession receives the sample and transfer to Processing department

Use Case Number	8.4
Use Case Name	Head Accession receives the sample and transfer to Processing department
Description	Head Accession receives the sample and transfer to Processing department
Basic Flow	- The use case begins when Head Accession receives the sample and transfer to 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- Conditions	System with internet connection should be available
Post- Condition	Head Accession receives the sample and transfer to Processing department

Use case number: 8.4

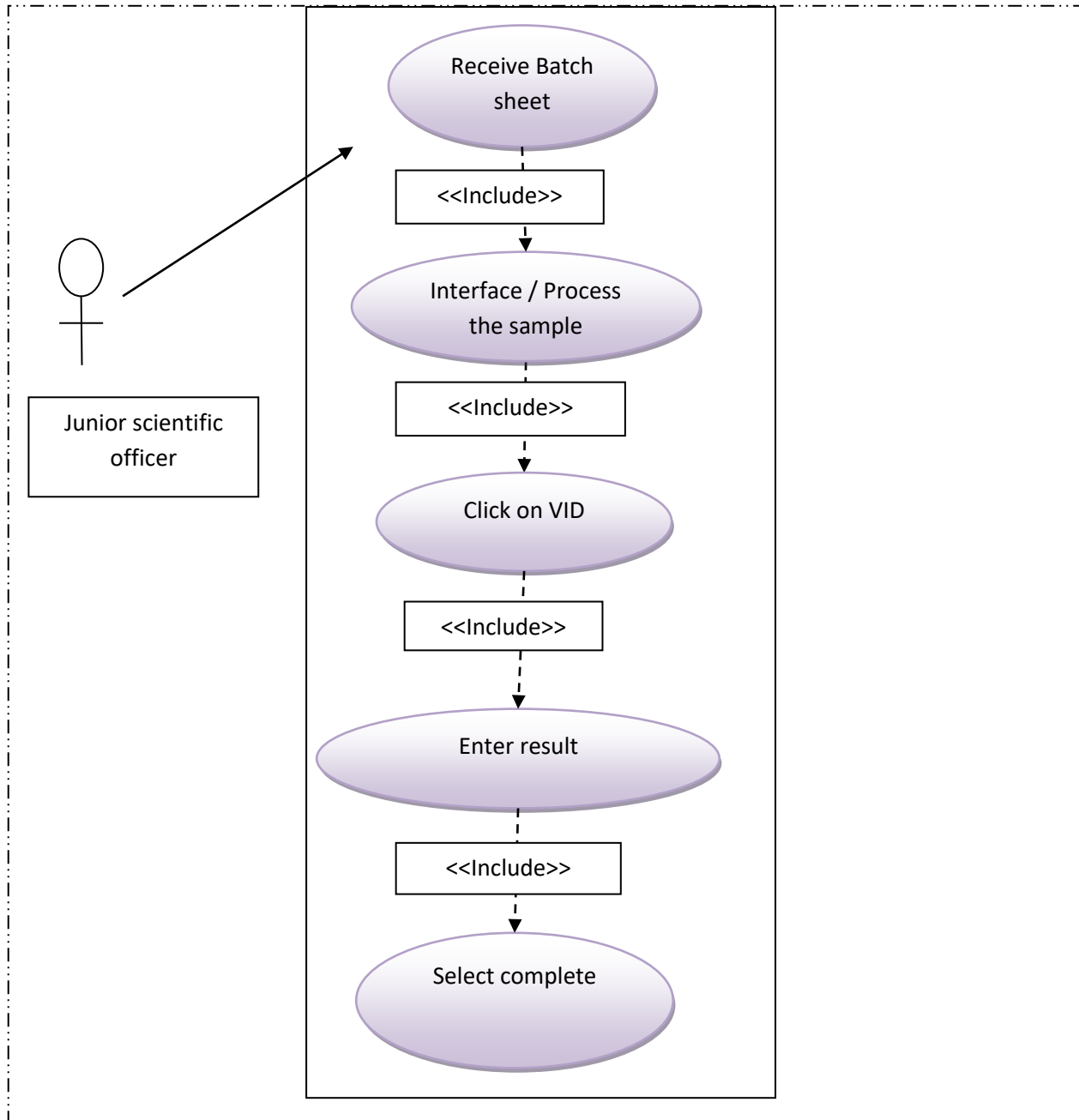Use case name: Head Accession receives the sample and transfer to Processing department

```
Click on VID
    |
<<Include>>
    |
Click on receive
Sample
    |
<<Include>>
    |
Click on Transfer
    |
<<Include>>
    |
Click on transfer location
    |
<<Include>>
    |
Generate Work
order
```

Head Accession

8.5 Junior scientific officer process the sample and enters the result

Use Case Number	8.5
Use Case Name	Junior scientific officer process the sample and enters the result
Description	Junior scientific officer process the sample and enters the result
Basic Flow	- The use case begins when Junior scientific officer process the sample and enters the result - Do interface / Sample processing - Click on VID - Enters result - Select complete The use case ends.
Alternate Course	- Sample is not received - Work order is not generated - Results not entered
Pre- Conditions	System with internet connection should be available
Post- Condition	Junior scientific officer process the sample and enters the result

Use case number: 8.5

Use case name: Junior scientific officer process the sample and enters the result
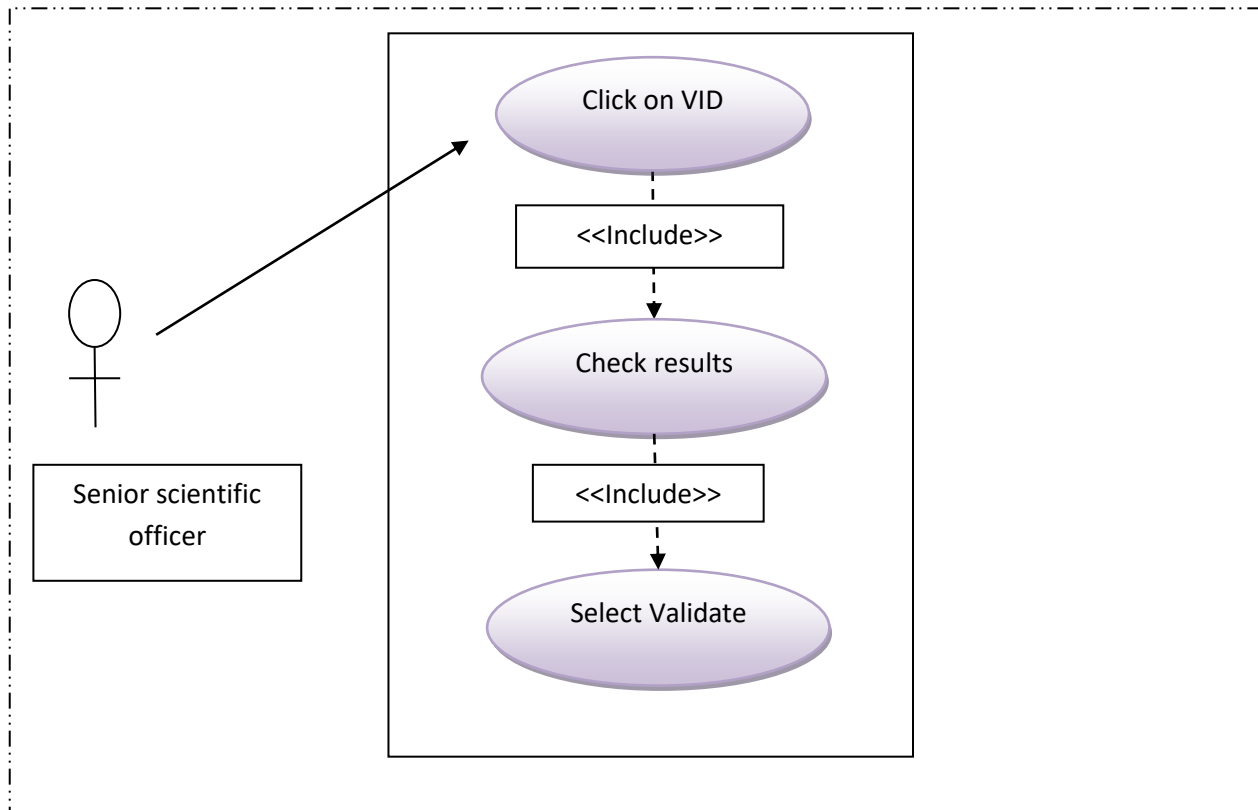
8.6 Senior scientific officer Validates the result

Use Case Number	8.6
Use Case Name	Senior scientific officer Validates the result
Description	Senior scientific officer Validates the result
Basic Flow	• The use case begins when 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 • Sample given for Reflex
Pre- Conditions	• System with internet connection should be available
Post- Condition	Senior scientific officer Validates the result

Use case number: 8.6

Use case name: Senior scientific officer validates the result

Click on VID

<<Include>>

Check results

<<Include>>

Select Validate

Senior scientific officer

8.7 Junior doctor Approves the results

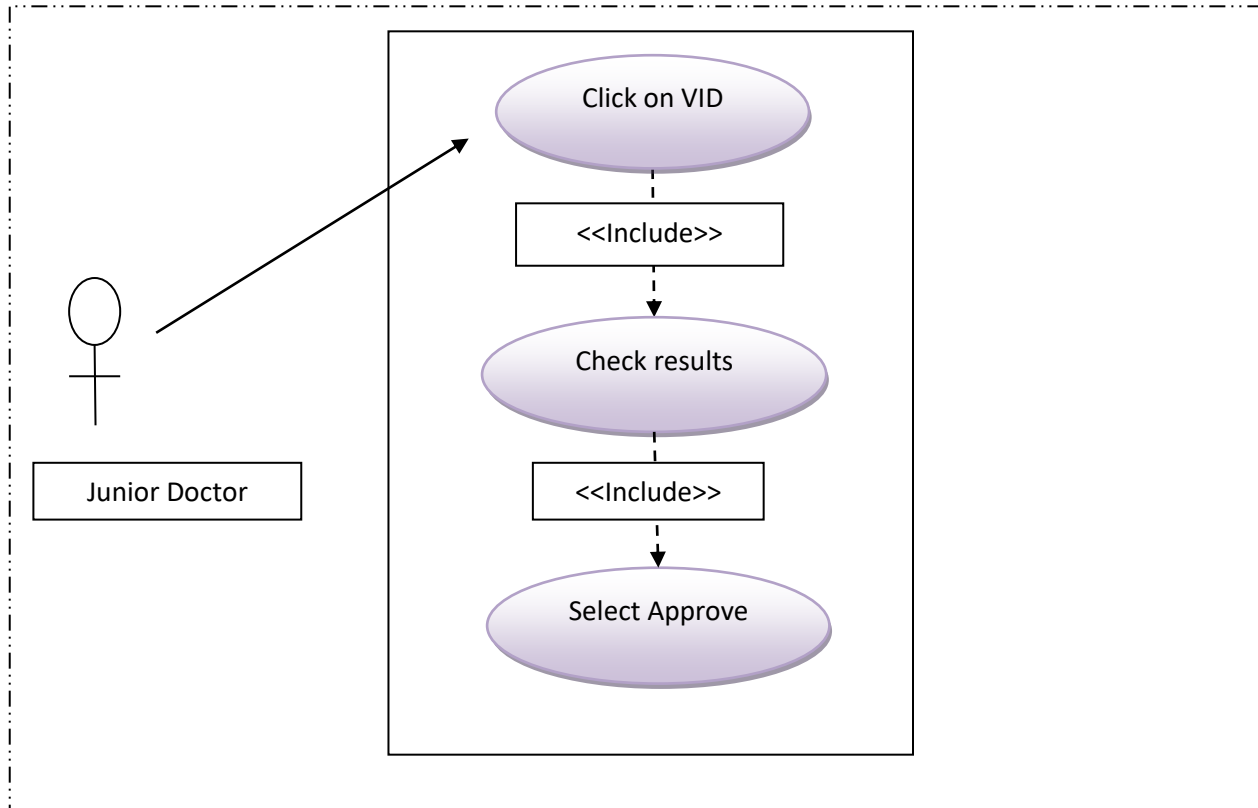| Use Case Number	8.7
Use Case Name	Junior doctor Approves the results
Description	Junior doctor Approves the results
Basic Flow	- The use case begins when Junior doctor Approves the results - Click on VID - Check the result - Select Approve The use case ends.
Alternate Course	- Result partially approve - Sample re-run
Pre- Conditions	System with internet connection should be available
Post- Condition	Junior doctor / Senior Doctor Approves the results

Use case number: 8.7

Use case name: Junior doctor Approves the results

8.8 Senior Doctor Approves the results

Use Case Number	1.G
Use Case Name	Senior Doctor Approves the results
Description	Senior Doctor Approves the results
Basic Flow	The use case begins when Senior Doctor Approves the results • Click on VID • Check the result • Select Approve The use case ends.
Alternate Course	• Result partially approve • Sample re-run
Pre- Conditions	• System with internet connection should be available
Post- Condition	Senior Doctor Approves the results

Use case number: 8.8
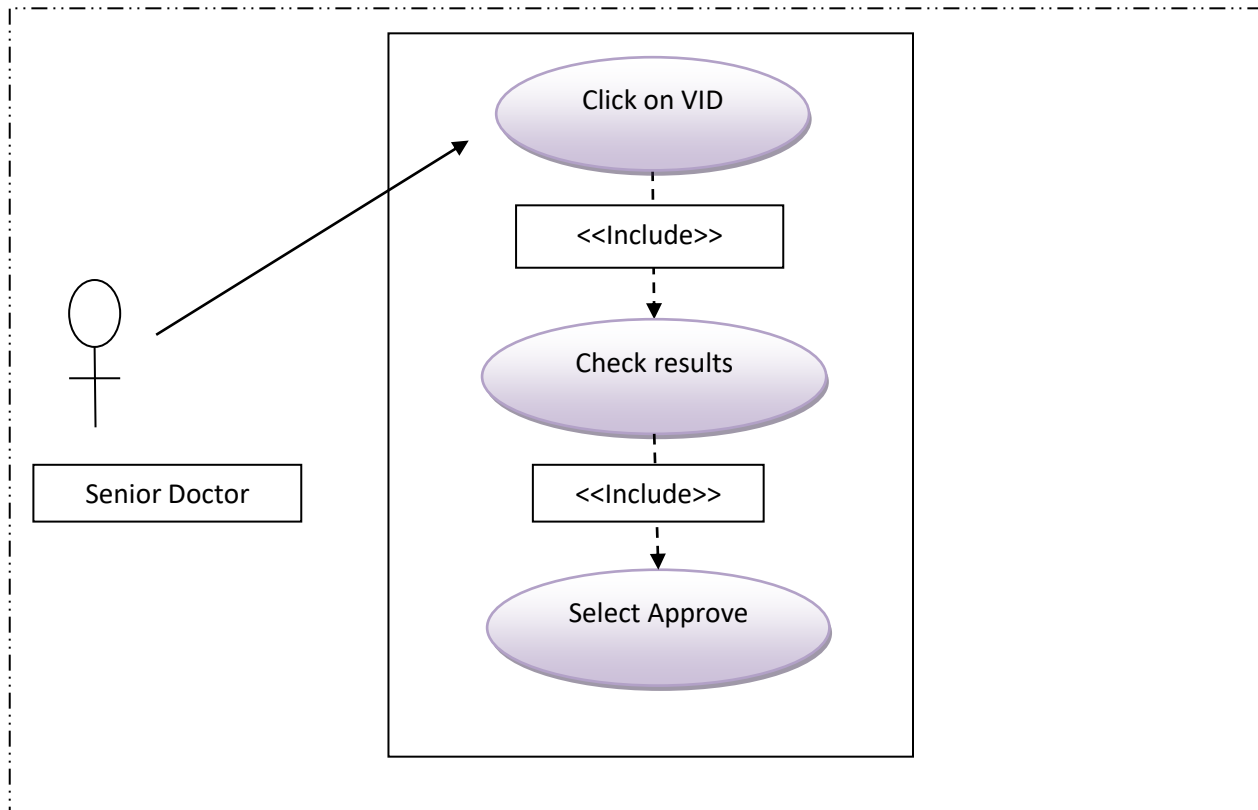
Use case name: Senior doctor Approves the results

Senior Doctor

Click on VID

<<Include>>

Check results

<<Include>>

Select Approve

9.Activity Diagram

9.A .Activity diagram for Registration
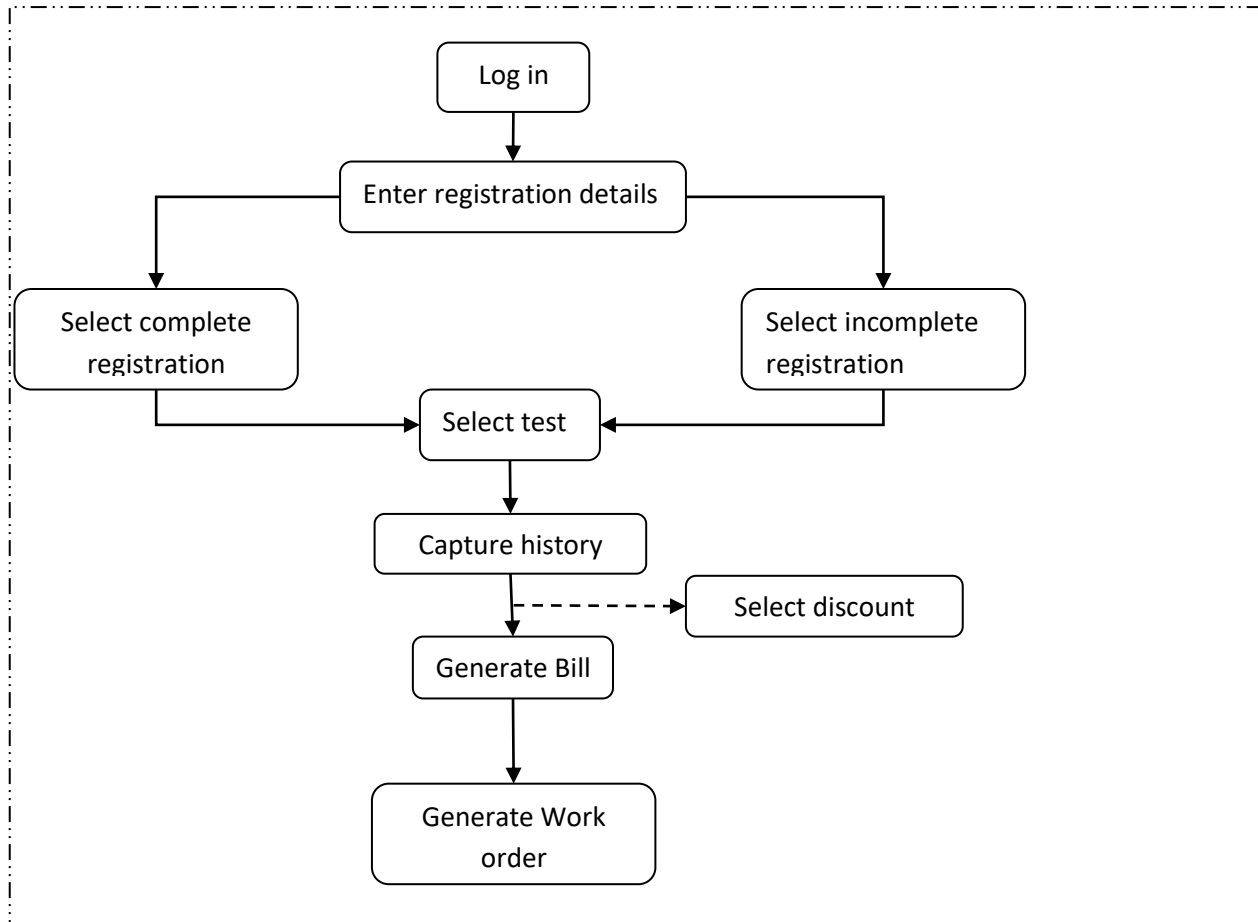
9.B. Activity Diagram for sample receive
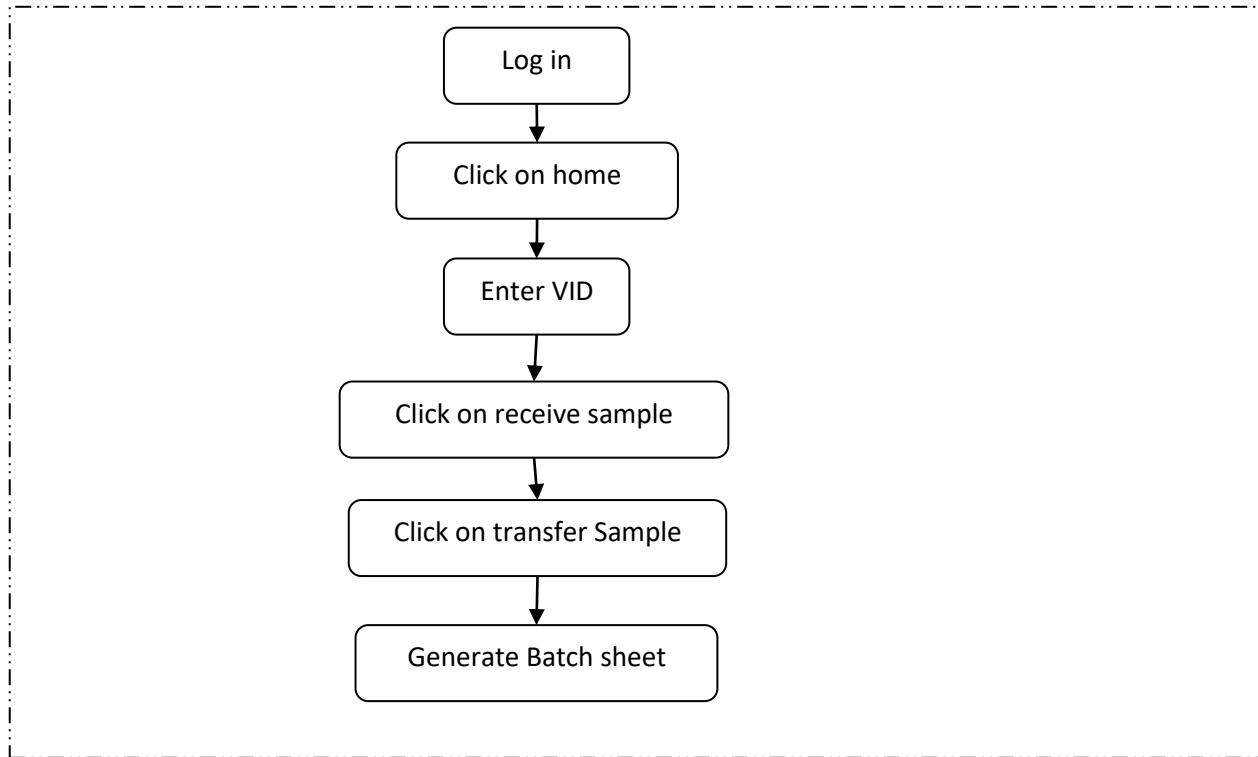
```
          ┌──────────────┐
          │    Log in     │
          └──────────────┘
                  │
                  ▼
          ┌──────────────┐
          │ Click on home │
          └──────────────┘
                  │
                  ▼
          ┌──────────────┐
          │   Enter VID   │
          └──────────────┘
                  │
                  ▼
      ┌────────────────────────┐
      │ Click on receive sample │
      └────────────────────────┘
                  │
                  ▼
      ┌────────────────────────┐
      │ Click on transfer Sample │
      └────────────────────────┘
                  │
                  ▼
      ┌────────────────────────┐
      │  Generate Batch sheet   │
      └────────────────────────┘
```

.9.C. Activity Diagram for Result entry

```
┌─────────────────┐
│     Log in      │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│  Click on home  │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│    Enter VID    │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│  Process sample │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│   Enter result  │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│ Click on Complete│
└─────────────────┘
```

9.D. Activity Diagram for Validation

```
┌─────────────────┐
│     Log in      │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│  Click on home  │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│    Enter VID    │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│  Check results  │
└─────────────────┘
         │
         ▼
┌─────────────────┐
│ Click on Complete│
└─────────────────┘
```
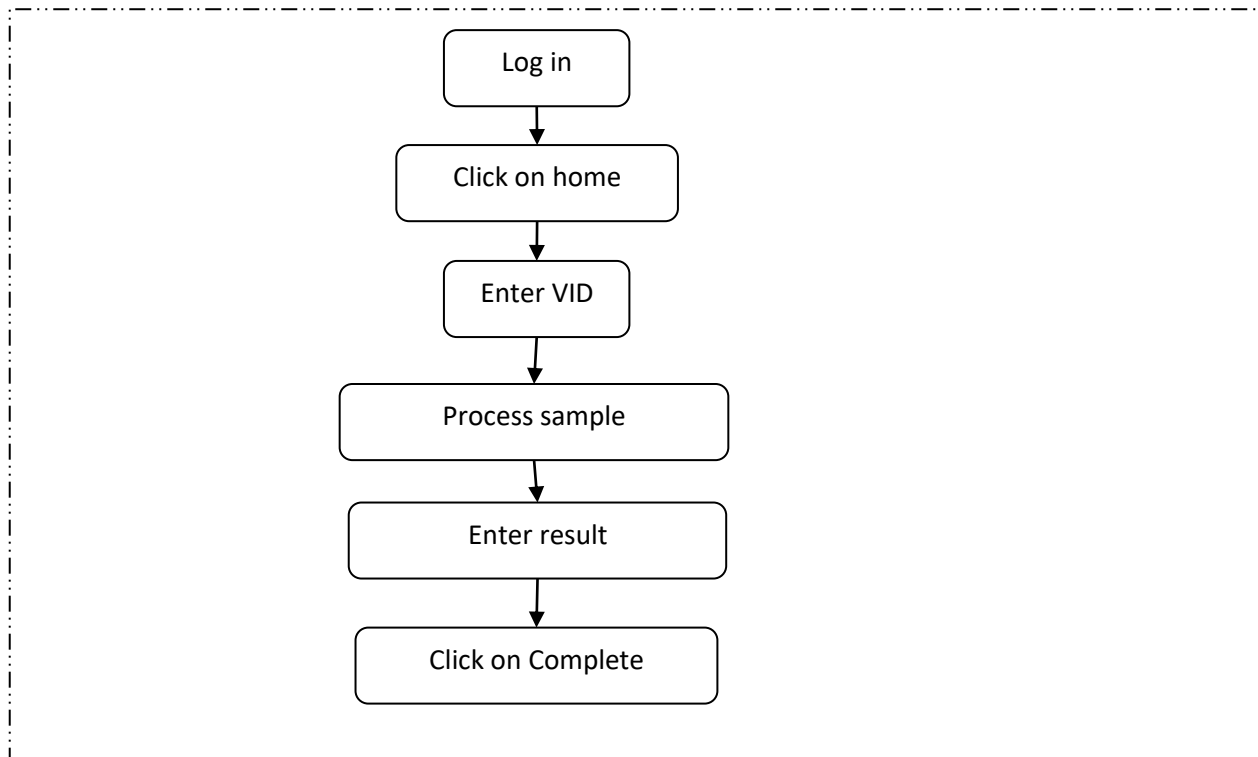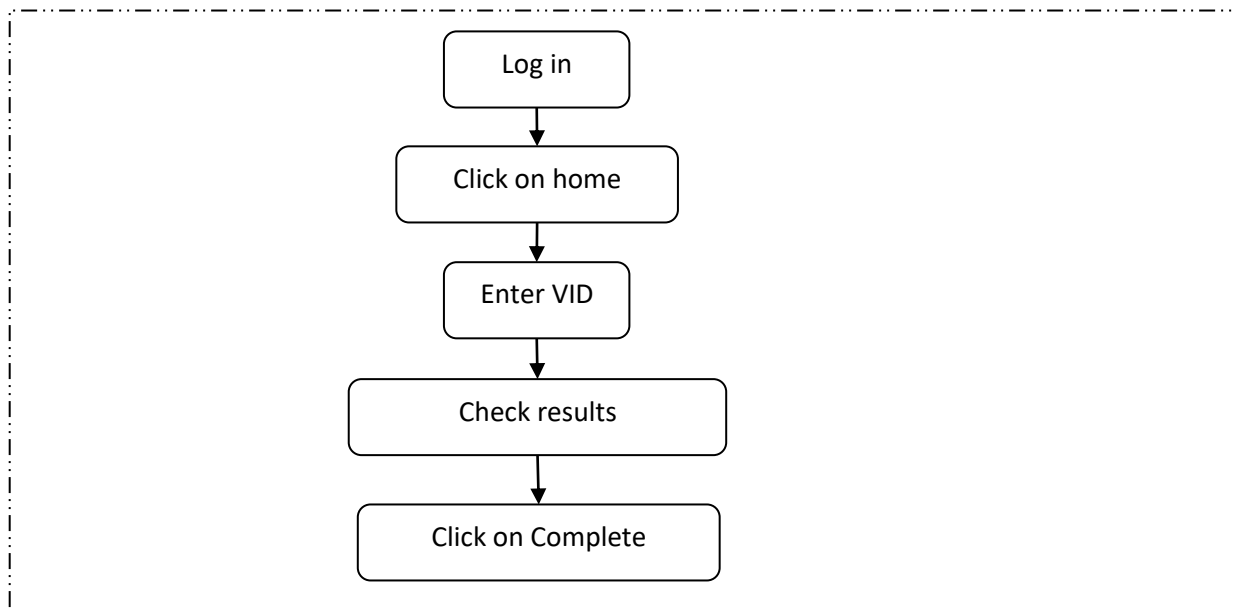
9.E. Activity Diagram for Approval

```
                    ┌──────────────┐
                    │    Log in    │
                    └──────────────┘
                           │
                           ▼
                    ┌──────────────┐
                    │ Click on home │
                    └──────────────┘
                           │
                           ▼
                    ┌──────────────┐
                    │  Enter VID   │
                    └──────────────┘
                           │
                           ▼
                    ┌──────────────┐
                    │ Check results │
                    └──────────────┘
                           │
                           ▼
                    ┌──────────────┐
                    │Click on approve│
                    └──────────────┘
```
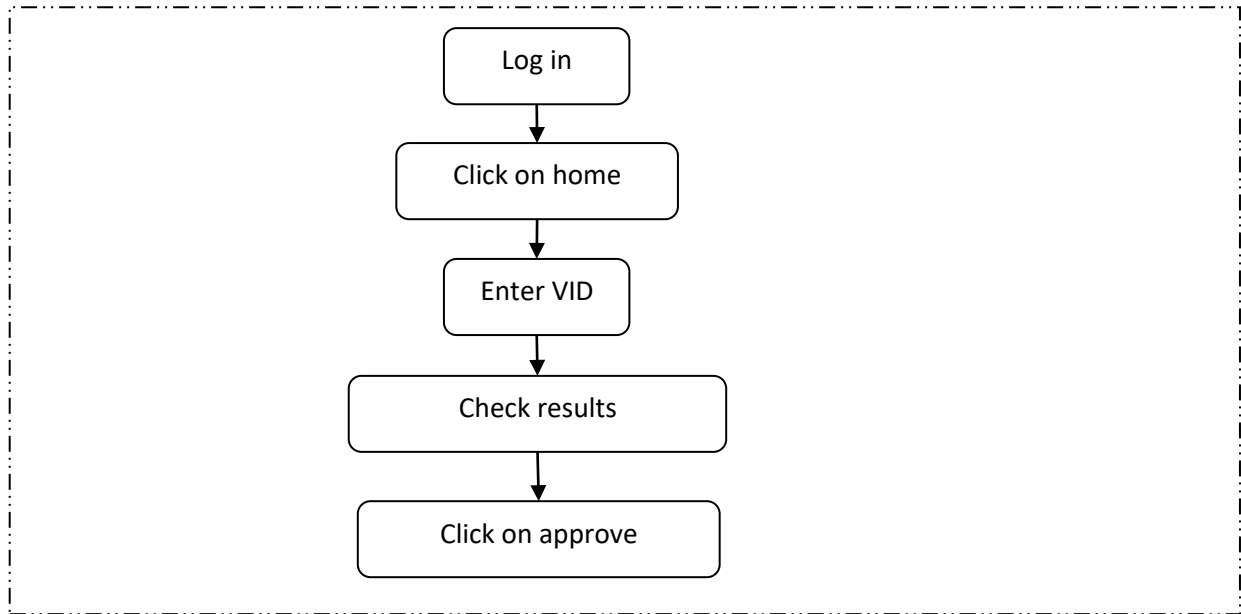
9.F Combined Activity diagrams

DEO REGISTARTION

Log in

↓

Enter registration details

↓

Select complete registration | Select incomplete registration

↓

Select test

↓

Capture history

↓

Generate Bill

↓

Generate Work order

PHLEBOTOMIST & ACCESSION

Click on home

↓

Enter VID

↓

Click on receive sample

↓

Click on transfer Sample

↓

Generate Batch sheet

JR.SCIENTIFIC OFFICER

Click on home

↓

Enter VID

↓

Process sample

↓

Enter result

↓

Click on Complete

SR.SCIENTIFC OFFICER

Click on home

↓

Enter VID

↓

CHECK RESULT

↓

Click on Complete

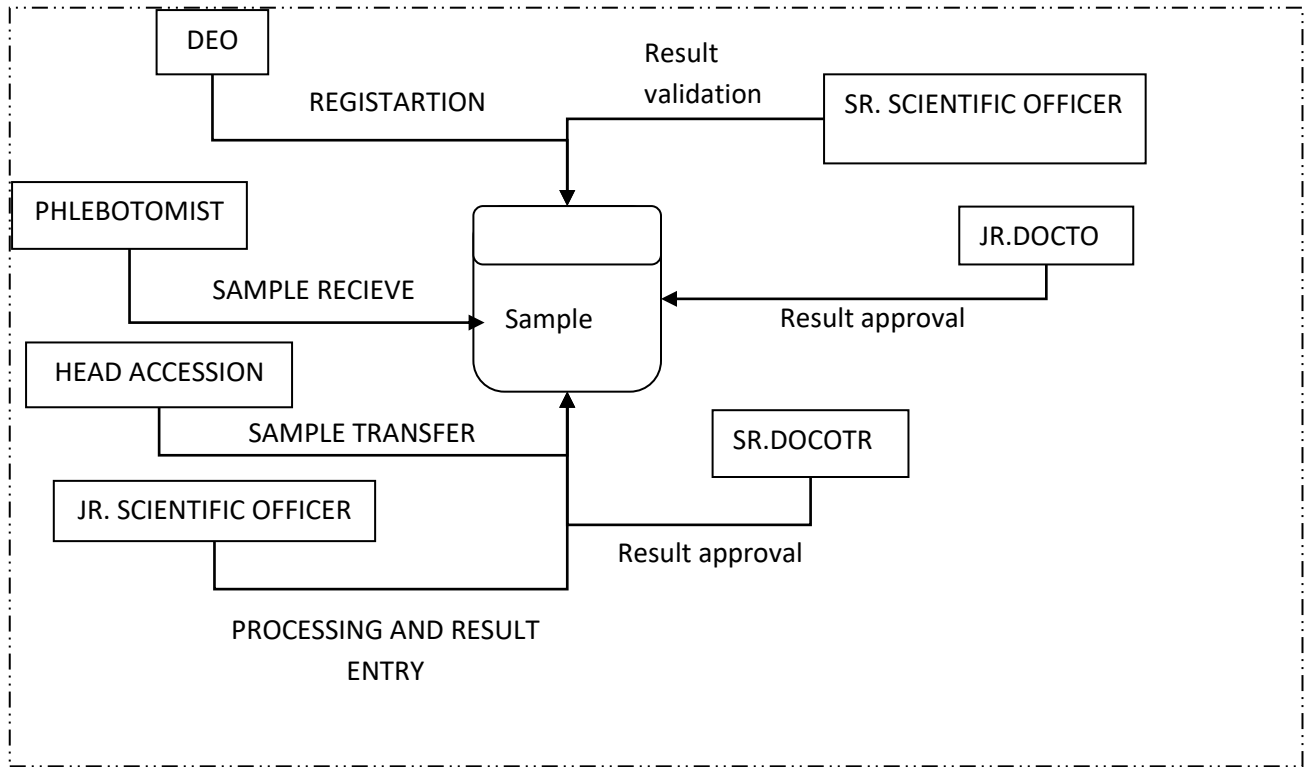### JR DOCTOR / SR.DOCTOR

Click on home
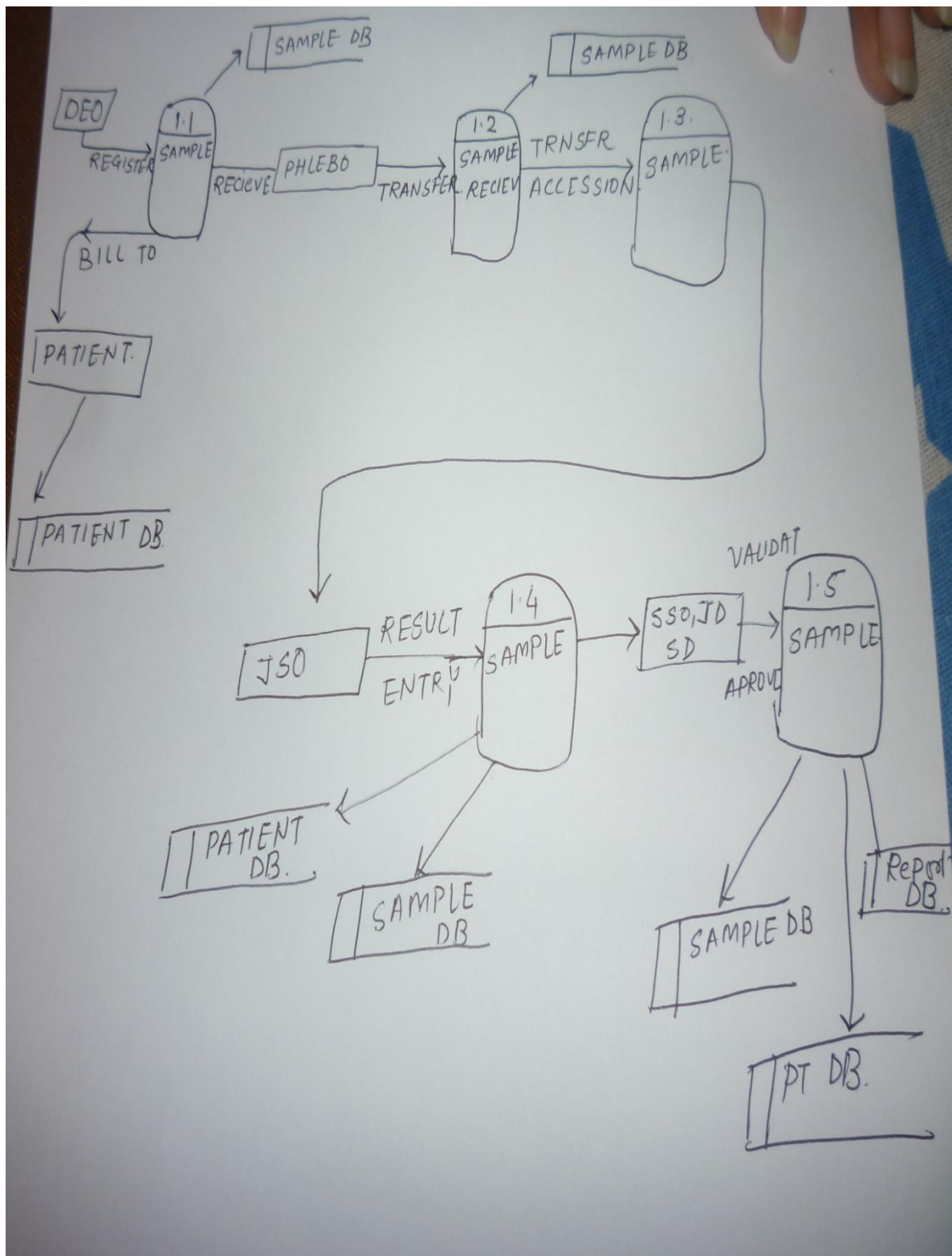
↓

Enter VID

↓

CHECK RESULT

↓

Click on Complete

10 .Data flow diagram

10.1Ground Level

10.2 Zero Level DFD

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