Data Mining, RFID Technology and a Mobile Based Information System for Improvement of Safety & Security of School Trips

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Introduction

The vehicular volume in road has been increasing day by day due to rapid urbanization. One of the major reason is that the school goers use private vehicles instead of the school bus as security and safety has become a very sensitive issue.

In my project, I have proposed a system for the improvement of safety and security of school trip services.

Overview

The system works in two phases.

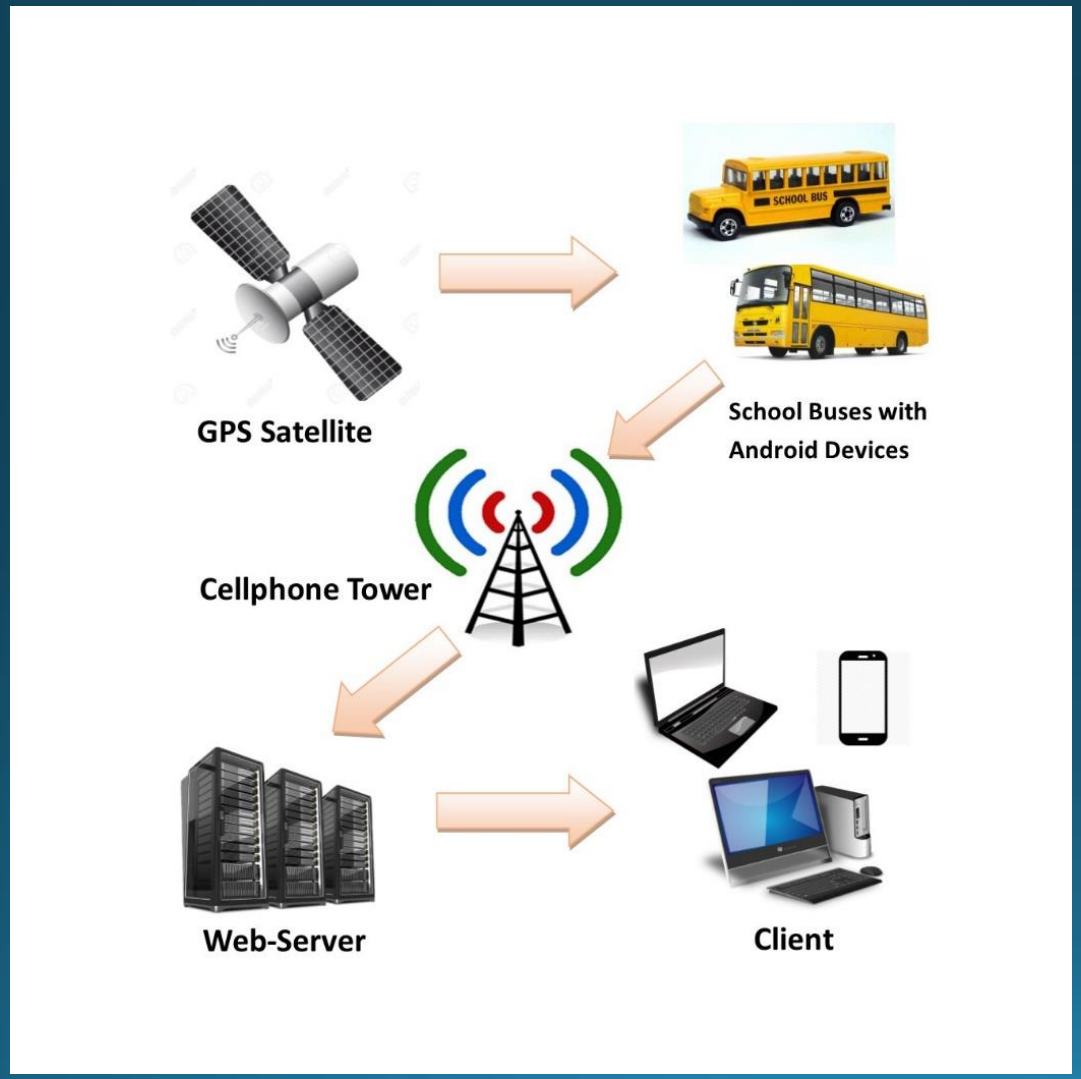
In the first phase,

I have developed an Android application using GPS technology & RFID technology. For data collection purpose, I have created a server using PHP. And to notify guardian about their child activities, SMS service has been implemented using GSM Modem & AT+ Commands.

In the second phase,

Due to huge growth of collected data in the server, data mining techniques with clustering has been used to find out the common bus outliers.

How System Works



Work Flow

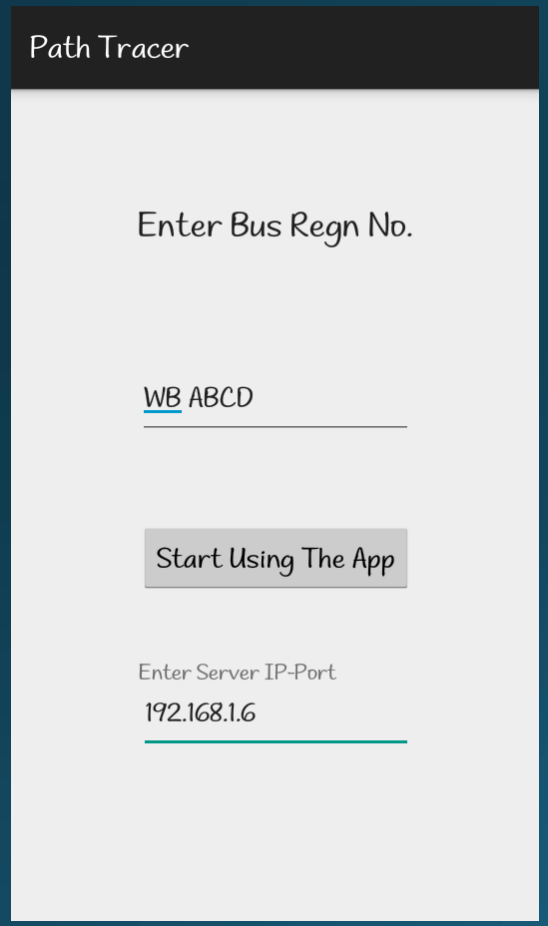
Mobile Device

i) An android device application using GPS technology will be installed in the bus.

ii) The application will track current latitude and longitude value of the bus and show travelling route on Google Map as well as send the data to server through internet.

iii) It will also be connected with a RFID reader device via Bluetooth. When a student check in the bus then his/her corresponding id will be scanned & send to the server.

Screen Shots (Mobile Device)



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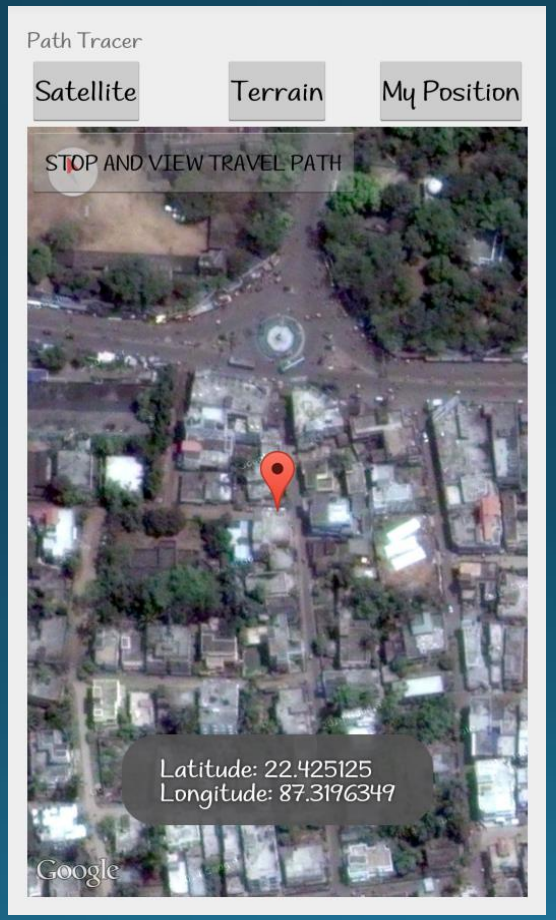

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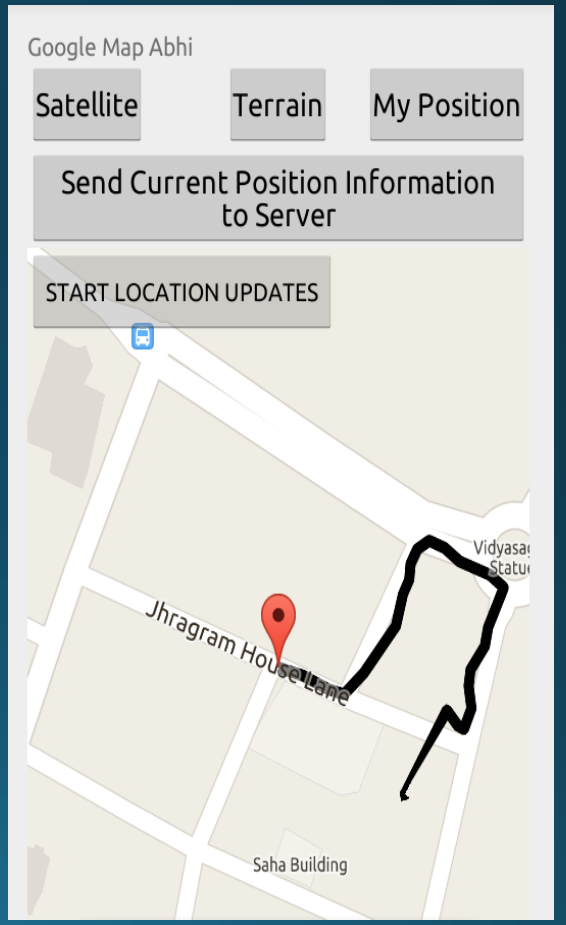

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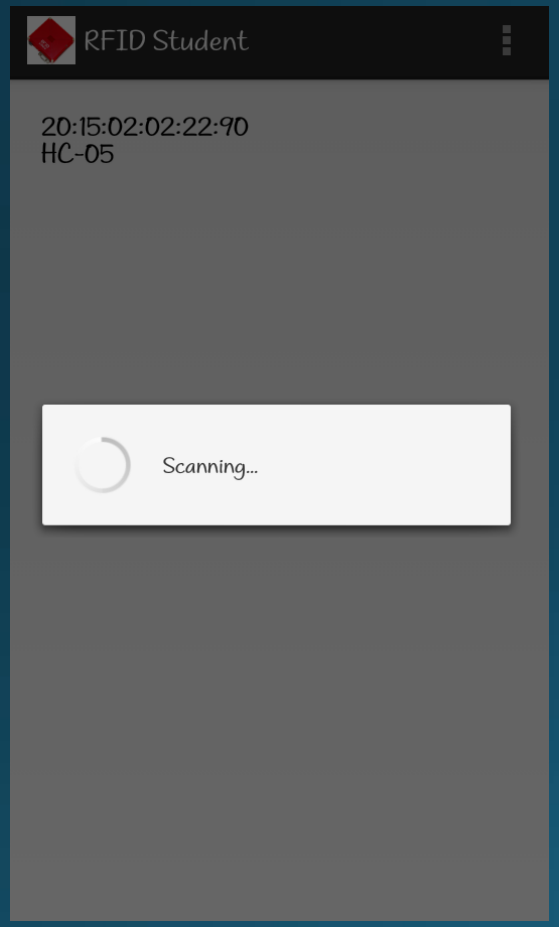
Screen Shots (Mobile Device)



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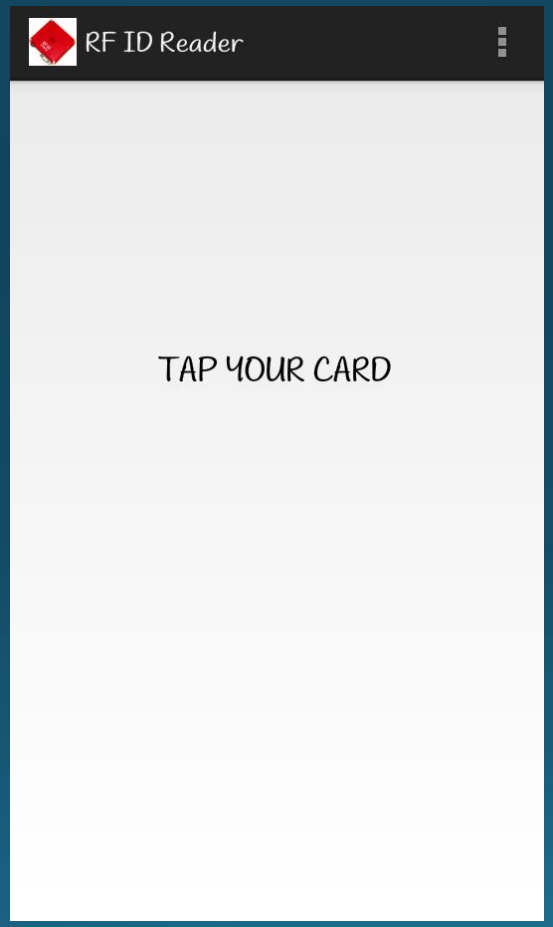

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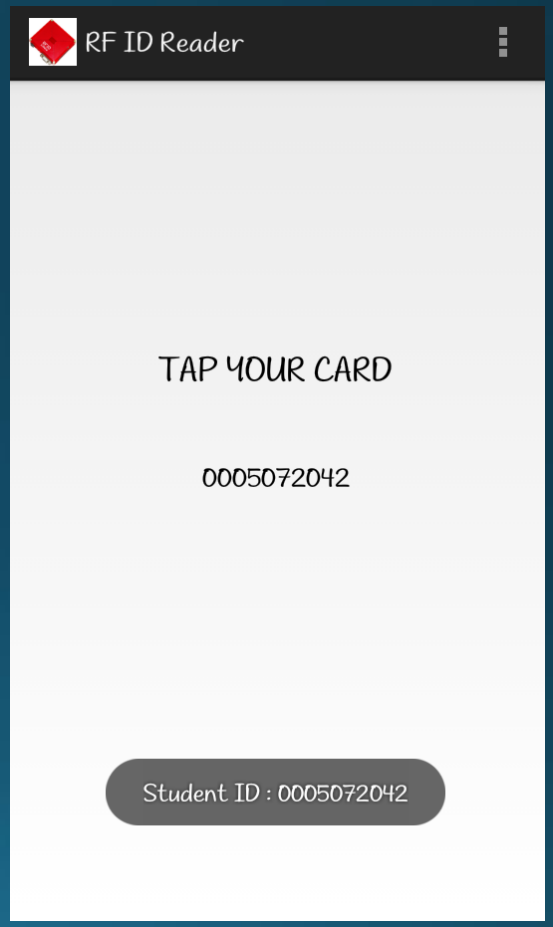

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Work Flow (Cond…)

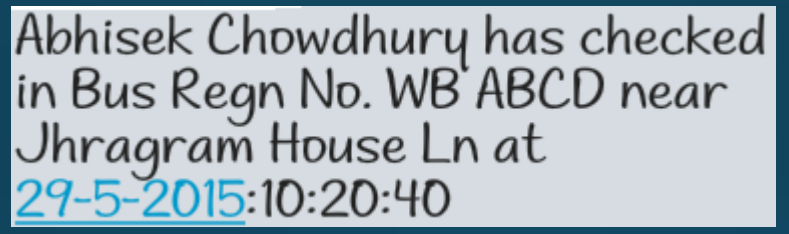
Server

i) In the server, SMS service has been implemented using a GSM Modem and AT+ Commands in PHP.

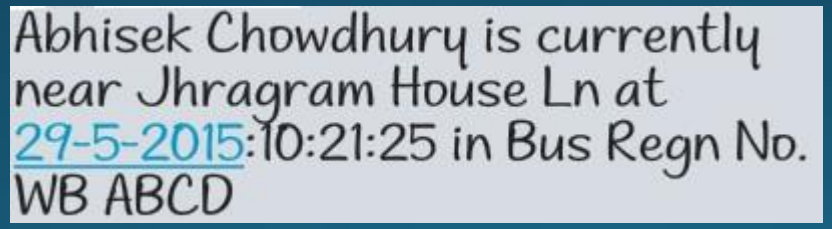
ii) Guardians will get instant SMS notification in their own mobile about when and where their child check-in or check-out from the bus and also get periodic notification about their location.

iii) Guardians can also see their child current position on Google Map from computer.

SMS Notification



When the student check in the bus



When student is already in the bus

Screen Shots (Server)

Home Student Current Location

Student Login :

Student ID:

Password:

Login

Admin Login :

Username:

Password:

Login

Screen Shots (Server)

Home Student Current Location

STUDENT HOME

Logout

Location updated on : 10:32:32 PM , 29-May-2015 , Fri

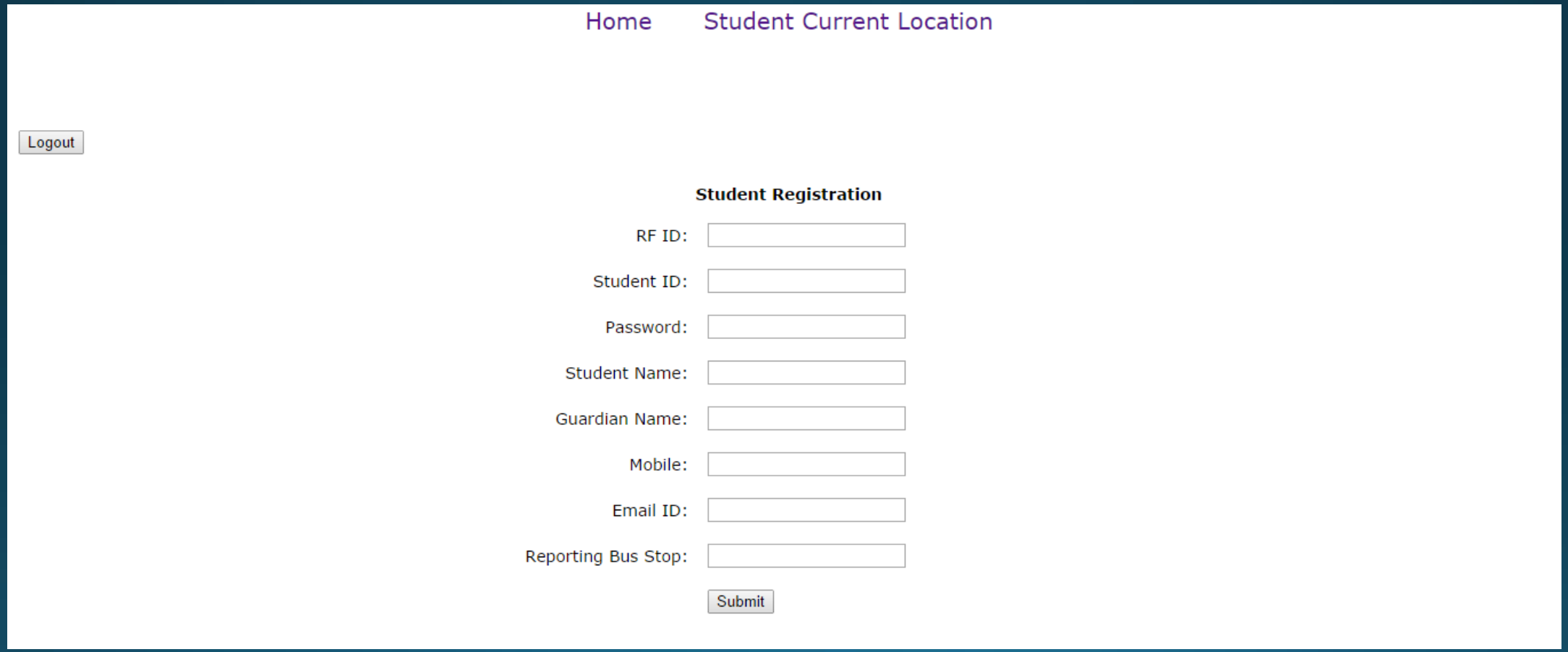
This page will refresh in every 5 seconds

Student Current Location is :-

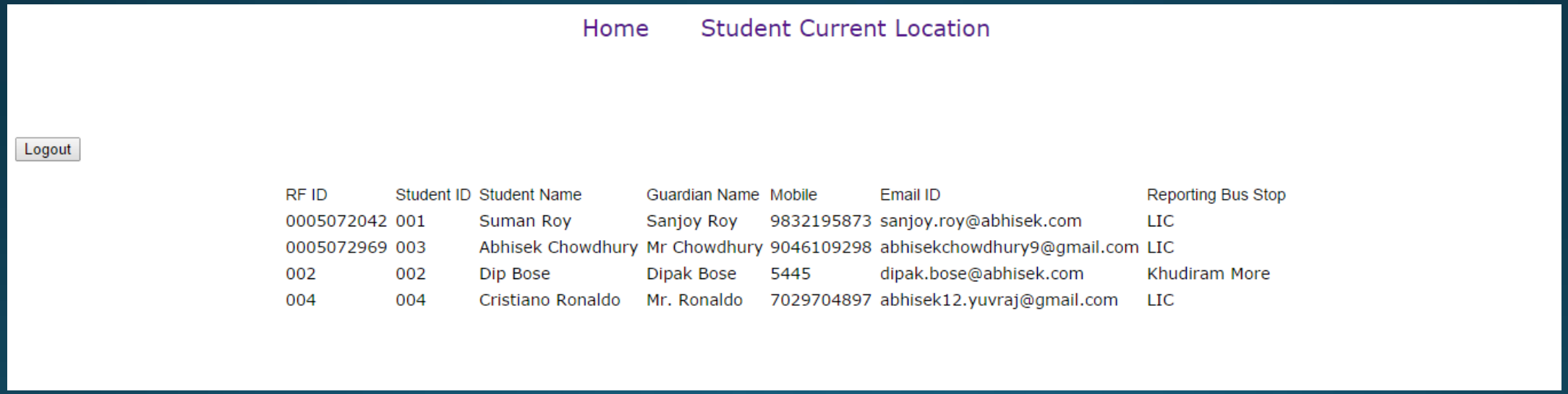
Bus Regn No	Latitude	Longitude	Location Name	Date-Time
WB ABCD	22.42513	87.3196949	Jhragram House Ln	29-5-2015:10:21:25

Screen Shots (Server)

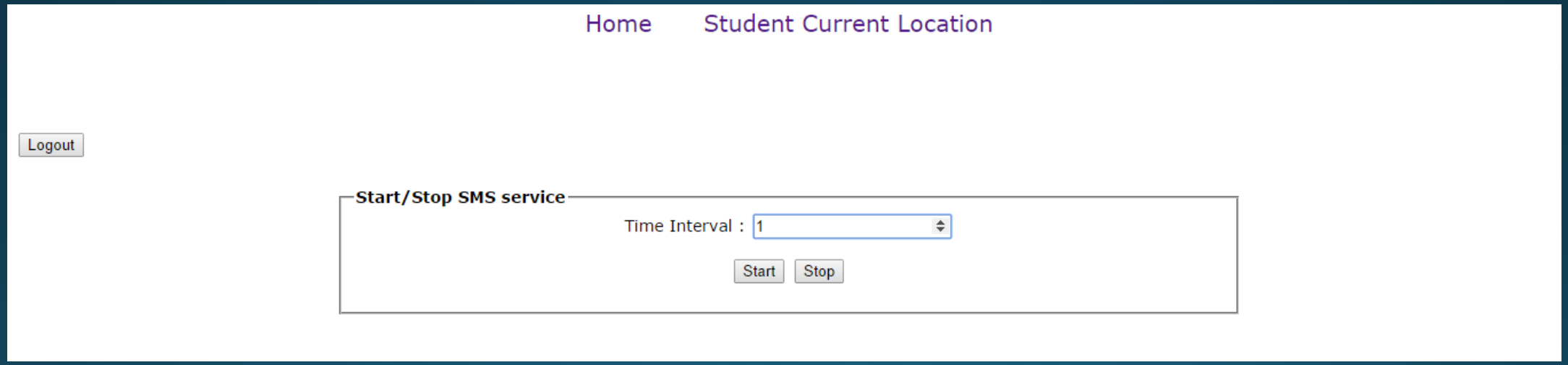
Screen Shots (Server)



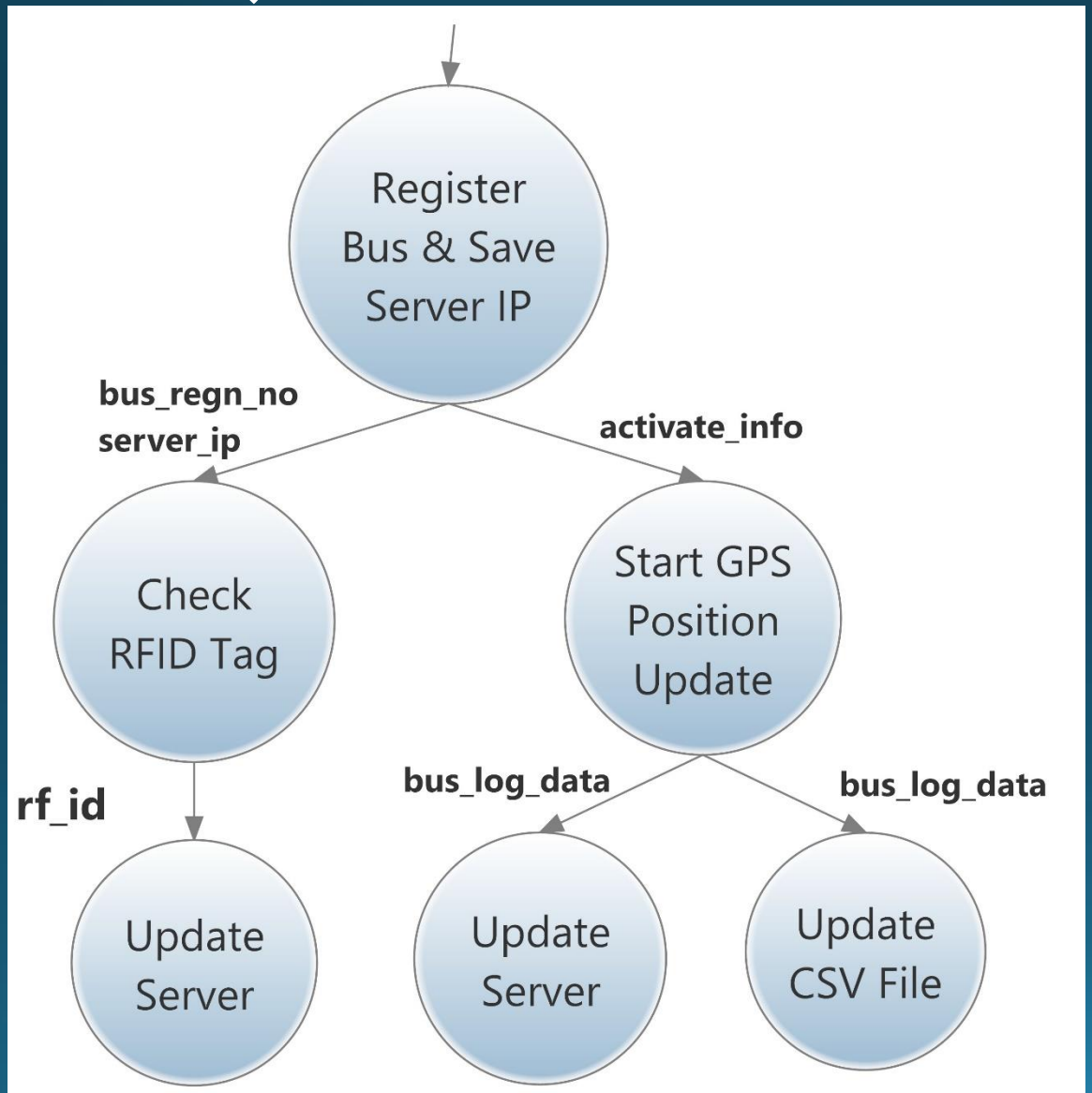
Screen Shots (Server)



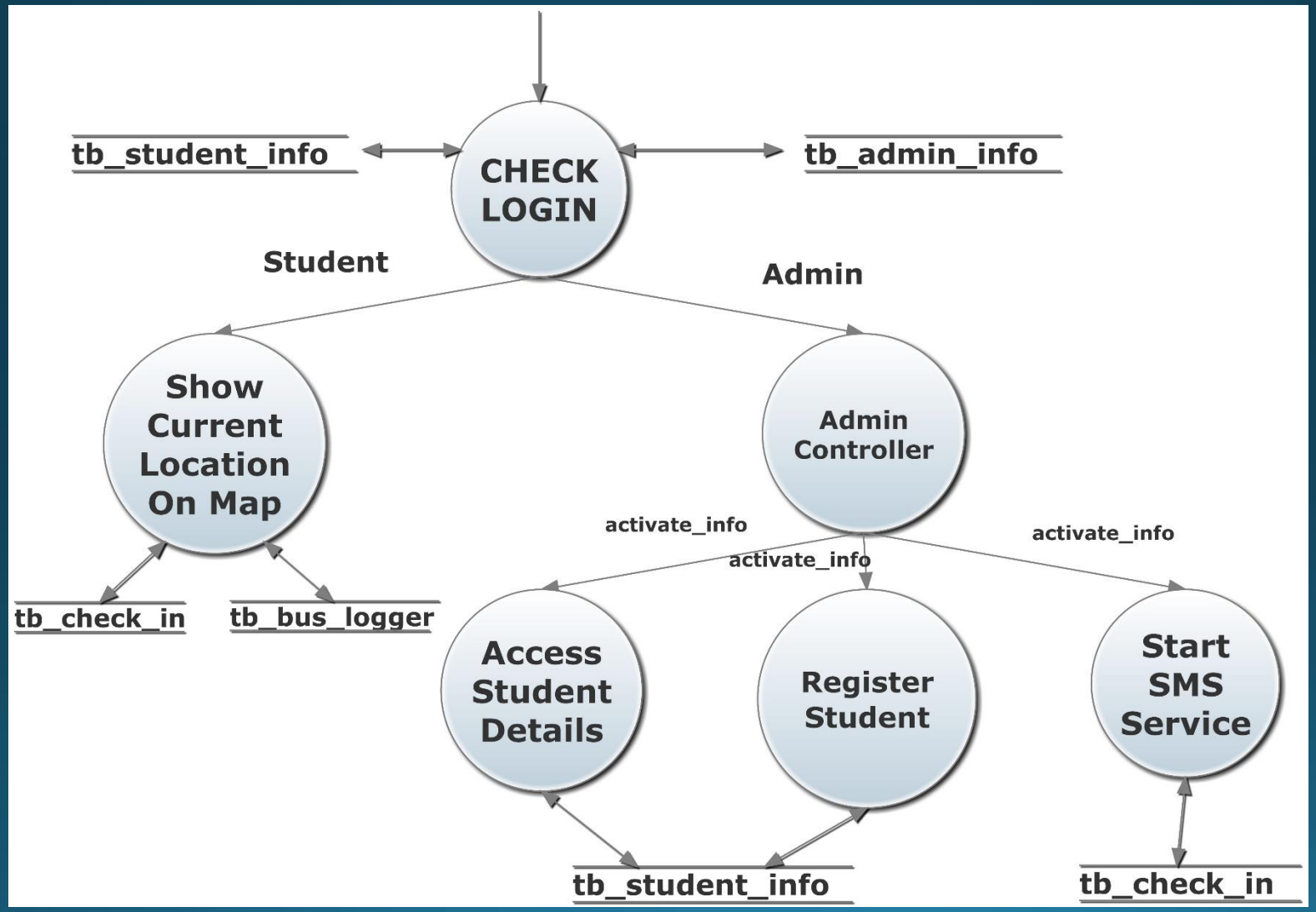
Screen Shots (Server)



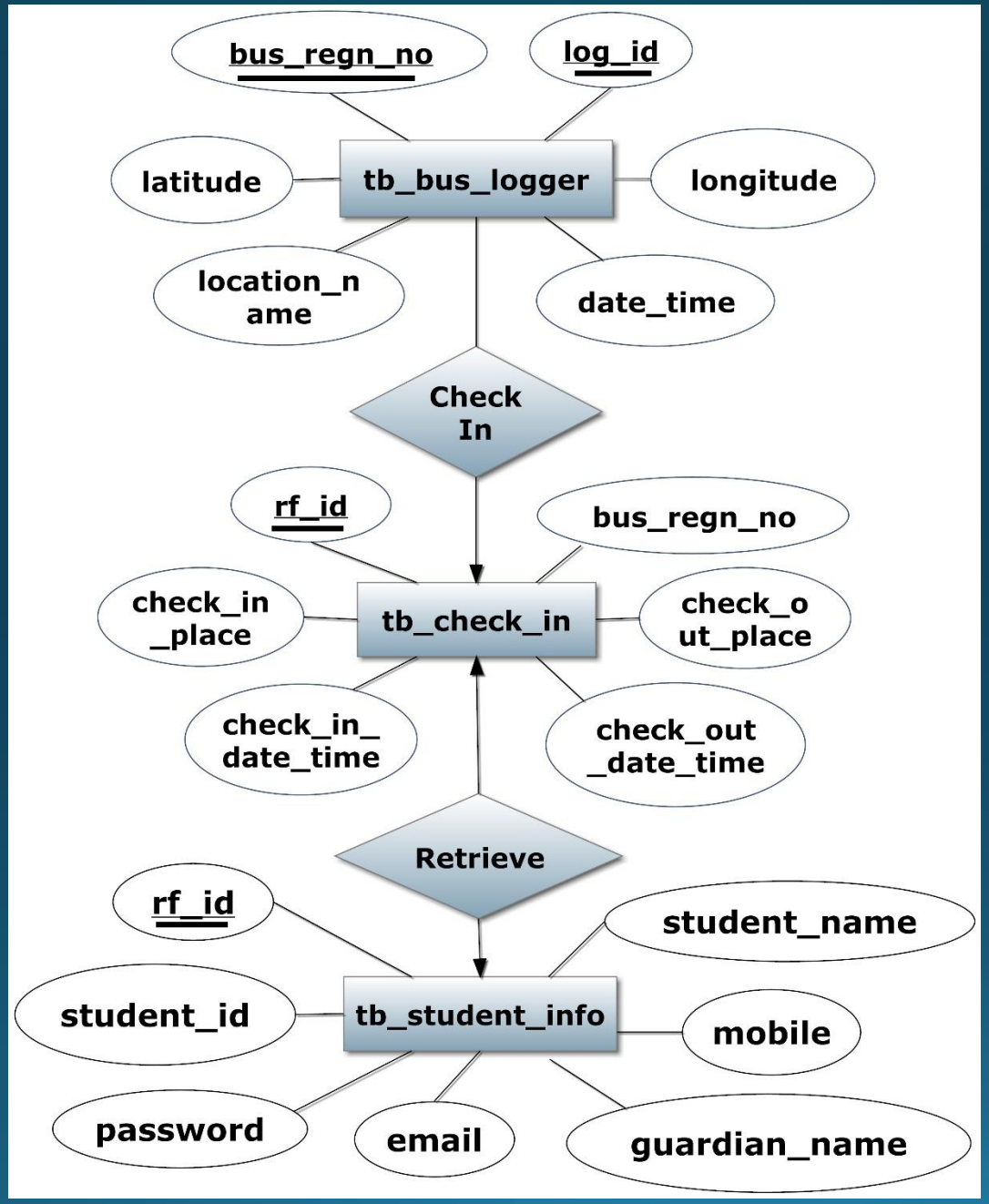
DFD (Mobile)


Register
Bus & Save
Server IP
bus_regn_no
server_ip
activate_info
Check
RFID Tag
Start GPS
Position
Update
rf_id
bus_log_data
bus_log_data
Update
Server
Update
Server
Update
CSV File

DFD (Server)


tb_student_info
CHECK LOGIN
tb_admin_info
Student
Admin
Show Current Location On Map
Admin Controller
activate_info
activate_info
activate_info
tb_check_in
tb_bus_logger
Access Student Details
Register Student
Start SMS Service
tb_student_info
tb_check_in

ER Diagram


bus_regn_no
log_id
latitude
tb_bus_logger
longitude
location_n
ame
date_time
Check
In
rf_id
bus_regn_no
check_in
_place
tb_check_in
check_o
ut_place
check_in_
date_time
check_out
_date_time
Retrieve
rf_id
student_name
student_id
tb_student_info
mobile
password
email
guardian_name

Sample of Collected Data

log_id	bus_regn_no	latitude	longitude	location_name	date_time
573	WB ABCD	22.42513	87.3196949	Jhragram House Ln	29-5-2015:10:21:25
572	WB ABCD	22.42513	87.3196949	Jhragram House Ln	29-5-2015:10:21:22
571	WB ABCD	22.42513	87.3196949	Jhragram House Ln	29-5-2015:10:21:20
570	WB ABCD	22.42513	87.3196949	Jhragram House Ln	29-5-2015:10:21:19
569	WB ABCD	22.42513	87.3196949	Jhragram House Ln	29-5-2015:10:21:17

tb_bus_logger

rf_id	check_in_date_time	check_in_place	check_out_date_time	check_out_place	bus_regn_no
0005072042	24-5-2015:9:4:13	Jhragram House Ln			WB ABCD
0005072969	24-5-2015:9:4:10	Jhragram House Ln			WB ABCD

tb_check_in

Algorithm: **Bus-route-allocation**

- **Input:**
  - R = Set of bus routes (r_1, r_2 … r_m)
  - B = Set of buses (b_1, b_2… b_n)
  - Xb_i = Capacity of every buses, where i > o
  - XS_i = Number of student checked-in a bus, where i > o
  - T = Capacity threshold

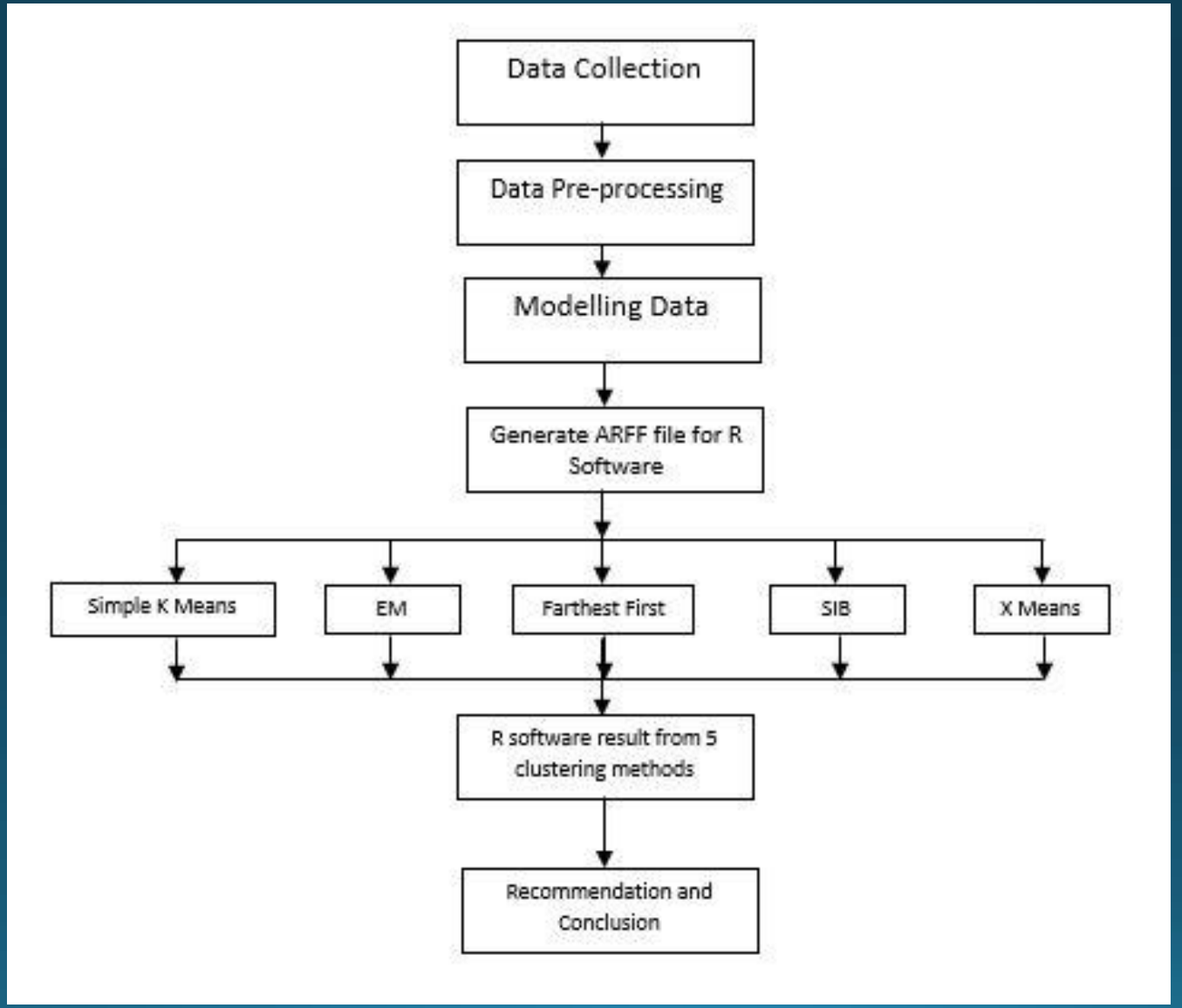
- **Output:**
  - Number of buses allocated to each route r_i , where i > o

Algorithm: **Bus-route-allocation** (Cond…)

```
Capacity [ri ] [bi] = XSi
Allocation [ri ] [bi] = ASi ∀ ri, bi; initially ASi = 0
For each route ri
    For each bus bi
        If ( location of bi ∈ route trajectory point set ) Then
            While ( bus location ≠ school location )
                Do
                Find XSi, number of student in each trajectory point
                Find Xbi, bus capacity of each trajectory point
                Allocation [ri][bi] +=Xbi
                If (Allocation [ri][bi] > (Xbi – XSi) -T ) Then
                    route[ri] += 1      // Allot a new bus to ri
                End_If
                If (Allocation [ri][bi] < ½((Xbi – XSi) -T) ) Then
                    route[ri] -= 1      //Remove a bus from ri
                End_if
            End_While
        End_if
    End_for
End_for
```

Data Mining

- METHODOLOGY



Common Bus Outliers

Bus Outliers	Number of clustering methods have the outlier	Clustering Method				
		Simple K Mean	EM	Farthest First	SIB	X Means
WB 02 A 3369	4	✓	✓	✓		✓
WB 02 8997	2		✓		✓	
WB 01 A 6601	4	✓	✓	✓	✓	

FUTURE WORKS

- Rating the bus drivers
- Traffic Management
- Dynamic route allocation for buses.
- Driver training programs and student safety awareness.

REFERENCE

- Han J. and Kamber M., "Data Mining: Concepts and Techniques, 2nd ed." Morgan Kaufmann Publishers, ISBN 1-55860-901-6, 2006
- Abdel Aziz Araar, Samar Alhasasneh, "Data Mining and RFID Technology for Rating Buses Driving", Vol. 4, 2013, ISSN 2079-8407
- *http://www.developer.android.com/*
- *http://www.php.net/*
- *http://www.stackoverflow.com/*
- *https://www.maps.google.co.in*

THANKYOU