SURVEILLANCE APPLICATION

(SAPP)

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ABSTRACT

SAPP is basically used for the surveillance of any object or person, but here our main focus are the children of the age of around 15 years as you can't give them mobile phones at that time of age and you want to stay aware of their movements as well, for example if they were supposed to be back from school but they are not back yet, SAPP can help you out to know where they are. It can also be used for mentally disable person as well because someone needs to stay with them all the time to take care of them but by using SAPP you can monitor them by using your android phone. In same way you can use it for your organization to monitor your subordinates during working time.

Main User can login to the SAPP using valid ID and Password and can monitor his child. The location of the child will be displayed on the Map using a pointer if you click on the pointer you can get the other details (Environment temp of child and Pulse rate).User can change password and set restricted areas as well for their children. If the children is present in any area which is set restricted for him a Restricted Area Alert will be sent to the main user even if he has not logged in to the device.

We have 2 main modules first is an android application called Surveillance Application (for main user) and second is a hardware gadget (for secondary user). In hardware gadget we have five modules (GPS module, GSM module, Temp sensor, Pulse detector and a Mini Processor) all connected in a wired network.

GPS module, Temp sensor and Pulse detector will get the readings from environment and will send it to the Mini Processor. The Mini Processor will add up all the readings into a string and will send it to the android device through GSM-SMS technology. On the other hand android device will receive the SMS and extract the readings from the SMS, after extracting all the readings will be displayed through SAPP.

DECLARATION

We declare that the work presented herewith is the result of sole effort of our group, comprising of GC Muhammad Bilal, GC Javed Akhtar and GC Safeer Iqbal and it is free of any kind of plagiarism in part. We also declare that the dissertation has never been submitted previously in part or whole in support of another award or qualification either at this institution or elsewhere.

CERTIFICATE OF CORRECTNESS AND APPROVAL

Certified that work contained in this thesis "**Surveillance Application**" carried out by GC Muhammad Bilal, GC Javed Akhtar and GC Safeer Iqbal under the supervision of Dr. Naima Iltaf for partial fulfillment of Degree of Bachelor of Software Engineering is correct and approved.

APPROVED BY

_____

Assistant Professor Dr. Naima Iltaf

Computer Software Department

Military College of Signals (NUST)

DATED:_____

DEDICATION

In the name of Allah, the Most Merciful, the Most Beneficent

To our parents& instructors, without whose unflinching support and cooperation,

a work of this magnitude would not have been possible.

ACKNOWLEDGEMENTS

There is no success without the will of ALLAH Almighty. We are grateful to ALLAH, who has given us guidance, strength and enabled us to accomplish this task. Whatever we have achieved, we owe it to Him, in totality. We are also grateful to our parents and family and well-wishers for their admirable support and their critical reviews. We would like to thank our supervisor. Dr.Naima Iltaf and Lec Mobeena for their continuous guidance and motivation throughout the course of our project. Without their help we would have not been able to accomplish anything.

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CHAPTER:1

1 INTRODUCTION

The section introduces the Software Requirements Specification for the Surveillance APP (SAPP) to its readers. The aim of this document is to gather, analyze and provide an in-depth insight of SAPP, by defining the problem statement in detail.

1.1 Purpose

Tracking technology has vast variety in the market these days. SAPP application will be one of them that will facilitate main user to track secondary user using sensing device. Sensing device will have the facility to put it on wrest and can locate the location of secondary user. Senor will sense the pulses and will transmit signals using GSM and will capture on device. That device will have the facility to capture the signals and respond as graphical view to the main user. Every main user will have their separate account through which he will be log in to the system and will monitor all the secondary users in his domain. Main user will have the authority to monitor the location of any secondary user that comes in his domain and will find his current location through GPS module. GPS module will be activated all the time to update the location of secondary user. In case if secondary user removes device, an update/message will automatically send to the main user that the specific user is no more connected to the system. Similarly if in case of any accident if secondary memory pulses stops working, main user will get a message and will respond rapidly to the accident and will locate him easily.

Furthermore, system will have module of temperature that senses the environment's temperature and in case of any change in environment's temperature, a message will be generated and send to the main user regarding the change in temperature. In case of high temperature, location of the secondary user can be located and can take necessary actions accordingly.

1.2 Project Scope

SAPP is surveillance application that would use GSM technology and sensing device to locate the remote person known as secondary user of SAPP environment. Sensing device will work on pulse detection that will inform the main user that secondary user is connected to the system and working properly. In case if heartbeat stops working, main user will get a message that secondary user is no more connected to the system. GSM will transmit a message to the main user and through GPS main user will get the last

location of the secondary user immediately and necessary actions will be taken accordingly. Another module of temperature will also be embedded in the system that will tell the main user about the secondary user's location as well as temperature of that specific place.

1.3 Benefit

The main advantages that could be achieved from this system are

- Location of the remote person connected to the SAPP environment.
- In case of any damage, necessary actions will take place.
- Any change in temperature, main user will get message.
- If secondary user removes his device, main user will get message.
- It can be used in a controlled environment that a boss needs to keep the track of his subordinates
- It can be used to keep the track of pets

1.4 Scope

FFDS is actually an early flood warning system that provides automatic flood warnings and real time discharge measurement & monitoring of a water body. The hardware end consists of a Wireless Sensor Network (WSN) of sensors to measure the water discharge.

The framework of FFDS has the capability & flexibility to be extended in future to carry out flood forecasting and control the complete irrigation system of Pakistan by utilizing the same established framework. However, currently due to limited resources (time, cost & manpower) the scope of this project is limited to automatic early flood warning and real time discharge monitoring of rivers and streams within Pakistan.

1.5 Objectives and Goals

- Establish a Wired Network to acquire real time data from sensors on the gadget.
- Constructing a low cost gadget holding all the sensors & the GPS so that it is cheap and easily deployable on the commercial level.
- Establish communication between remote Primacy User (Main User) and the secondary user using GSM technology.
- Develop an android application to store, manage and perform data processing (generates graphical views etc.) from data acquired from remote gadget.

- Create an android based portal for SAPP so that most recent location related information is easily available to the main user.
- Allow primary users (Main Users) to register with this system so that they can receive manual based location of secondary user via SMS.
- Generate automatic warnings and alerts in case of not working of heart beat sensor and huge increase of environmental temperature.
- Use maps to generate a graphical view of the deployed system in order to visualize the location of secondary user whom you are trying to find.
- It determines person's availability with his location using pulse sensor either the person is wearing the gadget or not.
- Improve our understanding of surveillance of secondary user.

1.6 Deliverables

Deliverable Name	Deliverable Summary Description
Software Requirements Specification(SRS) Document	Complete Description of **what** the system will do, who will use it. Detailed description of functional and non-functional requirements and the system features.
Design Document	Complete description of **how** the system will be implemented i.e. the detailed design.
Code	Complete code with the API.
Testing Document	The whole system is tested according to the specification described in the SRS document. Black box, unit and System integration testing is done.
Complete System	Complete working system.

Table 1 Deliverables

CHAPTER:2

2 LITERATURE REVIEW

The first step was to study in detail about the need and benefits of SAPP. The main focus was to learn about micro controllers; their programming and different sensors to calculate Pulse Rate and Temperature. The next step was to start building the hardware for the system, get readings from the sensors and an establishment of wired network then next step was to study about GSM module and sending the data from gadget to main user for using it in generating restricted area alerts and to do all the programing behind it.

2.1 V-IntelliTrac Pakistan's Anti-Theft Solutions Company

Vehicle Tracking (Pvt.) limited is the leading tracker company dedicated to Pakistani security. Their micro GPS/ GPRS/ GSM technology is serving to be the most technologically advanced system in the Pakistani market leaving their competitors in the bulk world.

The system operates by using the data provided by Geo Positioning Satellites (GPS) that are stationary throughout the globe that help determine the precise location of the vehicle or client being tracked. In an unfortunate event the vehicle tracking unit (VTU) manually and automatically sends a distress call to the servers at their multiple control rooms around Pakistan. Within seconds, after the situation is assessed the client's vehicle will come to a halt, engineers and the police will be notified of the clients GPS coordinates and the retrieval process will commence.

Reference: http://www.v-tracking.com/

2.2 GPS Tracking Devices and the Constitution of US

Advanced technology greatly enhances a police officer's ability to fight crime but presents challenging constitutional issues. One particularly helpful new tool is the global positioning system (GPS) tracking device, a computerized unit that police can attach to a suspect's vehicle and then monitor to track the vehicle's movements. The GPS device is similar to a traditional tracking device sometimes called a "bird dog," but GPS provides

more precise and detailed information. For example, the GPS unit can be programmed to transmit an electronic signal via a cell tower to a base unit approximately every five seconds. The officer monitoring it can determine the latitude and longitude of the vehicle, tell how long the vehicle remains at its location, view a computer screen containing a map of the area where the vehicle is located, and see where the vehicle is headed—all without leaving police headquarters.

Reference:http://www.policechiefmagazine.org/magazine/index.cfm?fuseaction=display_arch&article_id=179&issue_id=12004

2.3 Tracking a lost animal

How it works: Rubber collar with GPS unit and battery compartment communicates by radio with the owner's handset, which has its own GPS and compass. Handset displays distance and direction to the collar, updating continually. Display can be backlit for night use. This device doesn't require separate service.

Reference:http://www.consumerreports.org/cro/magazine/2012/04/how-to-track-a-lost-animal/index.htm

2.4 DynaTrack Courier Tracking

DynaTrack GPS offers Live GPS tracking, with a simple web interface, so you can monitor your fleet from anywhere. Keep track of all your vehicles with a powerful, easy to use web-based technology. Manage the disbursement and deployment of vehicles and drivers at all times with a bird's eye view from any computer. At an operational cost of as low as one dollar per day, the Live GPS tracking and maintenance module allows you to archive extensive data over time and also the ability to:

· Keep Costs Down	· Research Routes	· Manage Delivery Drivers
· Ensure Safe Operation	· Review Real Time Data	· Support Couriers
· Watch on the Web	· Decrease Delivery Time	· Monitor Fuel Consumption

Reference: http://www.dynatrackgps.com/courier-tracking

2.5 Aniogps A Tracking Company

Anio Electronics Inc. based in Pasadena, CA, is a branch office of Bofan Information Technology Co. Ltd, a China based manufacturing company. With 10 years of experience in designing and developing vehicle-mounted electronics and GPS products.

Aniogps provides you different range of tracking devices.

2.5.1 Activity Tracker

Hiking provides a sense of adventure for hikers on the trails. It allows them to connect with nature and offers peace and solitude. For the most part, hiking is a safe activity; however, there can be times where hikers experience problems. For those who want to hike, especially in dangerous or isolated areas, a GPS tracking device can make the difference between life and death.

Reference: http://aniogps.com/gps-industries/activity-tracker

2.5.2 Car Rental Tracking

Due to advanced tracking technology, car rental companies can worry a little less about rental car abuse. GPS Tracking is being used in increasing numbers by car rental companies across the country to monitor driver behavior

Reference: http://aniogps.com/gps-industries/car-rental-tracking

2.5.3 Waste Management Tracker

Do you ever wonder what it takes to coordinate a trash pickup? You'd probably be surprised to know how much goes in to ensuring that trucks end up collecting your trash. Beyond scheduling each truck within the fleet for certain areas, there is a degree of monitoring that must take place to make sure everything runs smoothly.

Reference: http://aniogps.com/gps-industries/waste-management-tracker

CHAPTER:3

3 SYSTEM REQUIREMENT SPECIFICATION

This part of the document contains information about the product, its features, perspective, users' characteristics and constraints.

3.1 Overall Description

SAPP is basically used for the surveillance of any object or person, but here our main focus are the children of the age of around 15 years as you can't give them mobile phones at that time of age and you want to stay aware of their movements as well, for example if they were supposed to be back from school but they are not back yet, SAPP can help you out to know where they are. It can also be used for mentally disable person as well because someone needs to stay with them all the time to take care of them but by using SAPP you can monitor them by using your android phone. In same way you can use it for your organization to monitor your subordinates during working time.

Main User can login to the SAPP using valid ID and Password and can monitor his child. The location of the child will be displayed on the Map using a pointer if you click on the pointer you can get the other details (Environment temp of child and Pulse rate).User can change password and set restricted areas as well for their children. If the children is present in any area which is set restricted for him a Restricted Area Alert will be sent to the main user even if he has not logged in to the device.

We have 2 main modules first is an android application called Surveillance Application (for main user) and second is a hardware gadget (for secondary user). In hardware gadget we have five modules (GPS module, GSM module, Temp sensor, Pulse detector and a Mini Processor) all connected in a wired network.

GPS module, Temp sensor and Pulse detector will get the readings from environment and will send it to the Mini Processor. The Mini Processor will add up all the readings into a string and will send it to the android device through GSM-SMS technology. On the other

hand android device will receive the SMS and extract the readings from the SMS, after extracting all the readings will be displayed through SAPP.

3.1.1 Product Perspective

Android technology is rapidly growing in today's era. It has become more user friendly as well as efficient to keep its user engaged to the new world and to make their life easier. It can be used in any field whether in the field of science or medical to facilitate end user effectively.

Surveillance application (SAPP) is the proposed project that will facilitate user in a very easy way to locate its subordinates and to keep check on them accordingly. It also has the feature to facilitate its main user with the facility to keep track of the environment where its subordinates are present, and if there is any change in their heartbeat or in the environment temperature, the main user to be informed on immediate basis to perform necessary action to avoid human loss.

The plan to carry out this project consists of 3 main tasks these are:

1. GSM technology usage to enable message exchange between primary and secondary user
2. Integrating android with hardware sensor
3. Integrating sub modules to form a system

3.1.2 Product Features

1. Establish network
2. Fetch sensor's measurement
3. Acquire current location of the secondary user
4. Send measurements to main user
5. Login-main user
6. Change password
7. Manage the gadgets
8. View map
9. Restricted area alerts
10. Receive measurements on SAPP

SF-1 Establish Network

Description	All sensor nodes (Pulse Sensor, TemperatureSensor, and GPS Module) need to be connected through wire to transfer data. So the mini processing unit in the gadget establishes a mini network to which all the sensor nodes are connected.
Priority	High
Pre-Conditions	All sensor nodes and mini processing unit is turned on
Stimulus/Response	**Mini processing unit creates a wired network** All nearby sensor connect to the mini processing unit
Post-Conditions	All nodes are connected through a wired network
Risk	Medium

Table 2 Establish Network

Functional Requirements:

REQ-1 System shall automatically establish a network within a gadget.

SF-2 Fetch sensor's measurements

Description	All sensors (Pulse Sensor, TemperatureSensor, GPS Module) must acquire real time measurements and this information is stored in the mini processing unit and later on sent to main server.
Priority	High
Pre-Conditions	All sensors are turned on and connected through a wire with mini processing unit.
Stimulus/Response	**Mini processing unit sends fetch command to all sensors one by one** Each sensor replies with the latest acquired measurement. However, if no reply is received for a long time error message is logged instead of storing the measurement.
Post-Conditions	Mini processing unit is updated with the latest measurements from all the sensors
Risk	High

Table 3 Fetch Sensor's Measurement

Functional Requirements:

REQ-2 The system shall automatically acquire readings from the sensors.

REQ-3 If a sensor fails or becomes unreachable an appropriated error message shall be generated

SF-3 Acquire Current Location of Secondary User

Description	Main user request for current location of the secondary user. A SMS is sent to the gadget, In response to this SMS the gadget start sending the current location, of the secondary user wearing the gadget, after regular interval. All the measurements are packed into a single SMS and transmitted to the main user.
Priority	High
Pre-Conditions	User need to be Logged in to some android device through valid ID and Password.
Stimulus/Response	**User log in to the SAPP and a SMS is sent to the gadget's mobile no.**. Data is packed into a single SMS and is sent to the main user.
Post-Conditions	Gadget starts sending the location after regular interval.
Assumption	If a request SMS is sent to the gadget then the gadget must have received it and behaved accordingly .
Risk	Medium

Table 4 Acquire Current Location of Secondary User

REQ-4 The android device shall automatically send a request SMS to the gadgetafter user has logged into the SAPP.

REQ-5 The gadget shall automatically send latest sensor's measurements to the main user after regular time intervals i.e. minimum after 1 min.

SF-4 Send Measurements To Main User

Description	The mini processing unit continuously fetches measurements from the sensor nodes (Pulse Sensor, Temperature Sensor, GPS Module) and temporarily stores the real time sensor measurements. These measurements are then packed into a single SMS and transmitted to the main user.
Priority	High
Pre-Conditions	A time interrupt is generated to transmit the measurements or a get measurement request is received from the remote location.
Stimulus/Response	**Data is packed into a single SMS and sent to main user's mobile no.** The gadget does not know whether sever has received the SMS or not.
Post-Conditions	gadget starts fetching again a new set of measurements from the sensors
Assumption	If an SMS is sent to the main user than the main user must have received it.
Risk	Medium

Table 5 Send Measurements To Main User

Functional Requirements:

REQ-6 The gadget shall automatically send latest sensor's measurements to the main user after regular time intervals i.e. minimum after 1 min.

REQ-7 The gadget shall send real time measurements to the main user if requested manually by the main user.

SAPP Main User Application:

The data acquired from the gadget is received at the main user side. The following use case diagram represents the functionality of this subsystem.

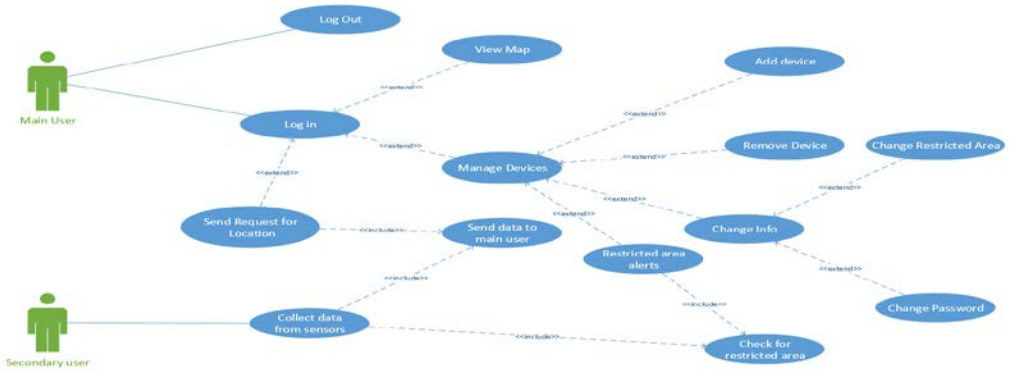


Figure 1 Main User Application 1

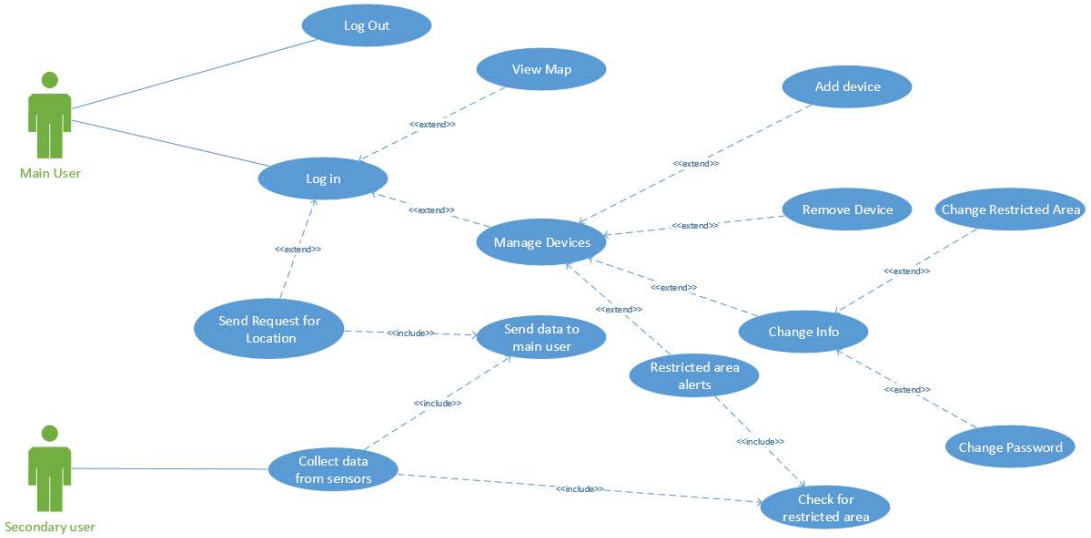


Figure 2 Main User Application 2

SF-5 Login –Main User

Use Case Name	Login
Actor(s)	Main User
Description	The SAPP application shall enable only the authenticate user to Login using their respective login credentials i.e. by providing the unique gadget's number and the associated password.
Pre-Condition	SAPP application is started, or some previously logged in actor has logged out.
Normal Course	**Login is Successful** • User enters gadget's number • User enters password • User Clicks on Login Button
Post-Condition	User has logged into the system and home screen is displayed
Alternate Course	**Login Failed due to invalid login credentials** • Password field is cleared • Error message is displayed that invalid login credentials are provided
Post-Condition	Login screen is displayed again and user is prompted to enter his/her login credentials again
Assumptions	The SAPP application has been successfully installed in the Android device and users have the valid Login credentials.
Priority	Medium
Risk	Low

Table 6 Login Main User

Functional Requirements:

REQ-8 The SAPP application shall only allow the authorized users to log into the system

REQ-9 The application shall keep a log of user login history

REQ-10 After five invalid login attempts the application shall be locked for 1 minute, however the background activities shall still be running.

SF-6 Change Password

Use Case Name	Change Password
Actor(s)	Main User
Description	The SAPP shall allow its users to manually change their login passwords.
Pre-Condition	The Main User has successfully logged into the system and has clicked on change password button on home screen
Normal Course	**Password Successfully Changed** • Enter a valid current password • Enter new password • Enter new password again for confirmation • Click on Change Password button
Post-Condition	Message is displayed that password has been successfully changed and home screen is displayed
Alternate Course	**Invalid Current Password is provided** • User enters invalid current password • User enters new password • User enters confirm new password • User clicks on Change Password **New password entered twice do not match** • User enters a valid current password • User enters new password and confirm new password that do not match. • User clicks on change password button
Post-Condition	Error message is displayed showing the appropriate error message i.e. 'Please enter a valid Current Password' or 'New passwords entered do not match'
Assumptions	Nil
Priority	Low
Frequency	Low
Risk	Low

Table 7 Change Password

Functional Requirements:

REQ-11 The SAPP application shall allow the main user to changethe password of any logged in gadget.

SF-7 Manage The Gadgets

Use Case Name	Manage the Gadgets
Actor(s)	Main User
Description	The SAPP shall receive data from a number of gadgets. So the application shall be flexible enough to add new gadgets, edit their information or delete a gadget from the application.
Pre-Condition	User navigates to manage gadgets menu
Normal Course	**Add a new Gadget** • User clicks on Add new gadgets • User enters valid information of the gadgets • User clicks the Add button **Delete Gadget** • User selects a gadget to Delete • User clicks on delete button • User clicks on delete button again when confirmation message is displayed **Edit Information** • User selects a gadget and clicks on change information • All information of gadget is displayed in editable textboxes. • User edits the information and clicks on save button.
Post-Condition	Confirmation Message is displayed i.e. 'A new Gadget Added' or 'Gadget successfully deleted' or 'Information Successfully updated'
Alternate Course	**Gadget already exists** User is displayed a message that gadget cannot be added because it already exists. **Information is missed in adding a Gadget** When user clicks add button the textboxes are highlighted, which contain invalid information or information is missed out. **Deletion Failed** If user clicks on No when deletion confirmation message is displayed.
Post-Condition	No changes are done to database and user taken back to Manage Gadgets screen
Assumptions	SAPP's local database is consistent and well maintained and there are no unexpected software error.
Priority	Medium

Frequency	Low
Risk	Medium

Table 8 Manage The Gadgets

Functional Requirements:

REQ-12 The SAPP shall allow the main user to manage gadgets which include adding new Gadgets, deleting a Gadget and updating information of already added Gadgets. (It shall be decided after the completion of requirement phase, that which information shall be stored about a Gadget)

SF-8 View Map

Use Case Name	View Map
Actor(s)	Main User
Description	The SAPP application shall display location of Gadgets on a map, in order to get a better visualization of gadgets. Whenever a gadget icon is clicked, its information and most recent measurements shall be displayed.
Pre-Condition	User clicks on Map button on the main menu
Normal Course	**User clicks on Gadget icon** Information of that gadget is displayed **User moves across the map** Location displayed by the map shall change **User zooms in and zoom out** As per the user action the scale of map displayed changes
Post-Condition	Map is displayed to the user
Priority	High
Frequency	High
Risk	Medium

Table 9 View Map

Functional Requirements:

REQ-13 A map shall be used to display the location of Gadgets across the country.

REQ-14 Once a Gadget is selected on the map its information and most recent measurements shall be displayed.

SF-9 Restricted Area Alerts

Use Case Name	Restricted Area Alerts
Actor(s)	Main User
Description	The Mini Processing Unit in the Gadget automatically compares the received measurements from the GPS with the values of restricted areas provided by the main user and generate Restricted Area Alerts. The Main User after logging into the system can view these Alerts.
Pre-Condition	Data is received from a Gadget, and the person wearing the gadget has reached the restricted area or he/she is about to reach.
Normal Course	**User is always prompted with the latest Restricted Area Alerts** • User clicks on Alerts to see its details **User Navigates to Restricted Area Alerts menu** • Alerts are displayed in chronological order • User can specify a time duration to view Alerts generated during that period of time
Post-Condition	Once a particular Alert has been viewed by the Main User it is marked as read.
Alternate Course	No Alerts are available
Post-Condition	A message is displayed that 'No latest Alerts are available' but user can still view old Alerts (if any).
Priority	High
Frequency	Medium
Risk	High

Table 10Restricted Area Alerts

Functional Requirements:

REQ-15 As soon as a restricted area measurement is received from GPS the gadget should generate the Restricted Area Alert within 2 seconds.

REQ-16 The gadget shall generate a particular Restricted Area Alert for the particular Areas specified by the Main User.

SF-10 Receive Measurements On SAPP

Use Case Name	Receive Measurements on SAPP
Actor(s)	Android device
Description	The Main User shall always be in active state to receive data from the Gadget through SMS.
Pre-Condition	SAPP application is turned on
Normal Course	• SAPP continuously checks the GSM module for any new data received • Received SMS is checked for its authenticity and information is extracted out of the SMS
Post-Condition	Measurements received are checked for generating Restricted Area Alerts
Alternate Course	• SMS received is not from any of the registered Gadget
Post-Condition	Received SMS is deleted and no Alerts are shown on the SAPP
Assumptions	GSM Module is turned on and already configured with the SAPP application.
Priority	High
Risk	High

Table 11 Receive Measurement On SAPP

Functional Requirements:

REQ-17 Once the SAPP application is turned on, it shall be in active state to receive measurements from gadgets whether the Main User has logged in or not.

REQ-18 The Android Device shall not store the rejected SMS.

3.1.3 Hardware Interfaces

Sensors are connected through wire with the mini processing unit. Arduino module is used to establish a network between the sensors in a gadget. The modules communicate with Arduino board via serial communication.

Furthermore, communication between Gadget and Android device is done by using the GSM module. The measurements are packed in an SMS and transmitted to the main user and vice versa.

Similarly, GPS module is attached with the mini processing via serial port to acquire global GPS coordinates. The data received via GPS module uses NMEA protocol, so GPS coordinates have to be extracted from the protocol packet.

In addition to other sensors temperature sensor is also connected with the mini processing unit and temperature is measured from the temperature sensor via analog pin of Arduino board (mini processing unit).

3.1.4 Software Interfaces

- System shall be installed on android device with version of ICS and latest to it.
- The android application shall be developed using Java on eclipse.
- For this application a number of API and external Libraries shall be needed i.e.
  - GMAP API, Google map API shall be used to display maps
  - Serial communication library shall be used to communicate with GSM Module.
- SAPP android application shall accessible on any android device connected through GSM.

3.1.5 Communications Interfaces

- All sensors in gadget are interconnected and finally managed by mini processing unit.
- For Communication between Gadget and android application, Short Message Service (SMS) of GSM technology is used. Each gadget is identified by its unique contact number.
- The android application of SAPP system shall use google map to show location of secondary user.

3.2 Other Nonfunctional Requirements

3.2.1 Performance Requirements

3.2.1.1 Response Time

The wired network shall be able to send measurements after regular intervals of at least 15 sec and at max 1 minute.

On the side of main user the response time of the application while fetching data from the database, response time must not exceed 1 sec on an average and 3 sec max, while evaluated through 1000 sample transactions.

The android application shall not take more than 5 seconds in loading the webpage on a standard 1Mbps internet connection.

3.2.1.2 Throughput

The mini processing unit and primary user application shall be tested simultaneously for a throughput of 5 primary users. This throughput must be tested at least for 3 hours contiguously.

3.2.1.3 Concurrency

A minimum of 25 concurrently active online registered users and 2 active system administrators must support the above base lined response time and throughput.

3.2.1.4 Reliability

- Failure rate of applications/transactions and hardware must not exceed 5 in 10,000.
- MTBF (mean time between failures) for any hardware componentshould be 1 week at minimum within first 6 months of deployment. However after 6 months of deployment MTBF must be 1 month.
- MTRS (mean time to restore service) must be 6hours max for critical, 4 hours max for major and 1 hour max for minor faults.

3.2.2 Safety Requirements

3.2.2.3 Integrity of information

In case of any hardware failure (i.e. any sensor has stopped working) or a hardware component has stopped responding (for at least 2 minutes) an appropriate error (TBD) should be generated and displayed to main user's application.

Measurements coming from all gadget should be in the same format and measurements should be in the same units.

3.2.2.4 Backup& Recovery

Backups of the database shall be maintained automatically every day at least once. In case server failure or database or the application gets corrupted, it should not take more than 1 hour to install the application again and load the backup database.

3.2.3 Security Requirements

3.2.3.3 Data Transfer

- The system shall use secure sockets in all transactions that include any confidential user information.
- The system shall automatically log out all customers after 10 minutes of inactivity.
- Commands, sent & received from primary user via SMS shall not be human understandable.
- The system shall not leave any cookies on the user's computer containing any of user's confidential data like username & password.
- Any data received by primary user that is not from the registered secondary user shall be rejected and deleted immediately.

3.2.3.4 Data Storage

- The applications shall never display a user password. It shall always be echoed with special characters representing typed characters.
- The system shall not store user's and administrator's passwords as a readable string in the database, but an alternate technique (TBD) like hashes should be used.
- The system shall only provide the facility to reset password but never show password to anyone in any case.
- The database shall also be protected with a password and the password should be changed at least once a month.

3.2.3.5 The product must be secure from following viewpoint of following criteria:

Authentication	Network eavesdropping; brute force attacks; dictionary attacks; cookie replay; credential theft
Authorization	Elevation of privilege; disclosure of confidential data; data tampering
Sensitive information	Access sensitive data in storage; network eavesdropping; data tampering
Session management	Session hijacking; session replay; man in the middle
Parameter manipulation	Query string manipulation; form field manipulation; cookie manipulation;
Exception management	Information disclosure; denial of service
Auditing and logging	User denies performing an operation; attacker exploits an application without trace; attacker covers his or her tracks

Table 12 View Points

3.2.4 Software Quality Attributes

- The application shall be scalable for at least 5 primary users.
- Data of locations older than 5 years shall be discarded for better system performance.
- System shall be flexible enough to cater different models of sensors which are attached with mini processing unit.
- System shall be modifiable if more sensors need to be added.

3.2.5 Usability

3.2.5.3 Graphical User Interface

- The system shall provide a uniform look in all application pages.
- The system shall provide colored graphs (line and bar graphs) for better visualization.
- The Map displaying secondary user shall be a colored one and different colors shall be used to highlight primary user.
- The android application shall provide colored icons and menu bars for navigation and better visualization & user experience.

3.2.5.4 Gadget User Interface

- A small embedded LCD shall be used to display real time measurements from the sensors.
- Different colored LEDs shall be used to display hardware errors and current state of hardware. (scheme to be developed in design phase)
- User shall be able to interact physically with the mini processing hardware using press buttons e.g. for resetting the hardware etc. (scheme to be developed in design phase)

3.2.5.5 Accessibility

i. Navigation between different menus and screens shall also be possible using keyboard commands and shortcuts (individual commands and shortcuts yet to be decided).

ii. The system shall only provide single language support i.e. English.

3.2.6 Reliability& Availability

i. The system shall be available and online 24x7, with no more than 3 hours of downtime per week for maintenance.

ii. There should be a contractual agreement with an internet service provider for T3 access with 99.99% availability for the main server.

iii. There should be an alternate computer sever, such that in case of main server failure, within a time span of 2 hours alternate server should be up and operational.

iv. Backup power source (UPS and Electric Generators) shall be provided in order to ensure maximum availability of the system.

CHAPTER:4

4 SYSTEM DESIGN SPECIFICATION

4.1 Work Breakdown Structure

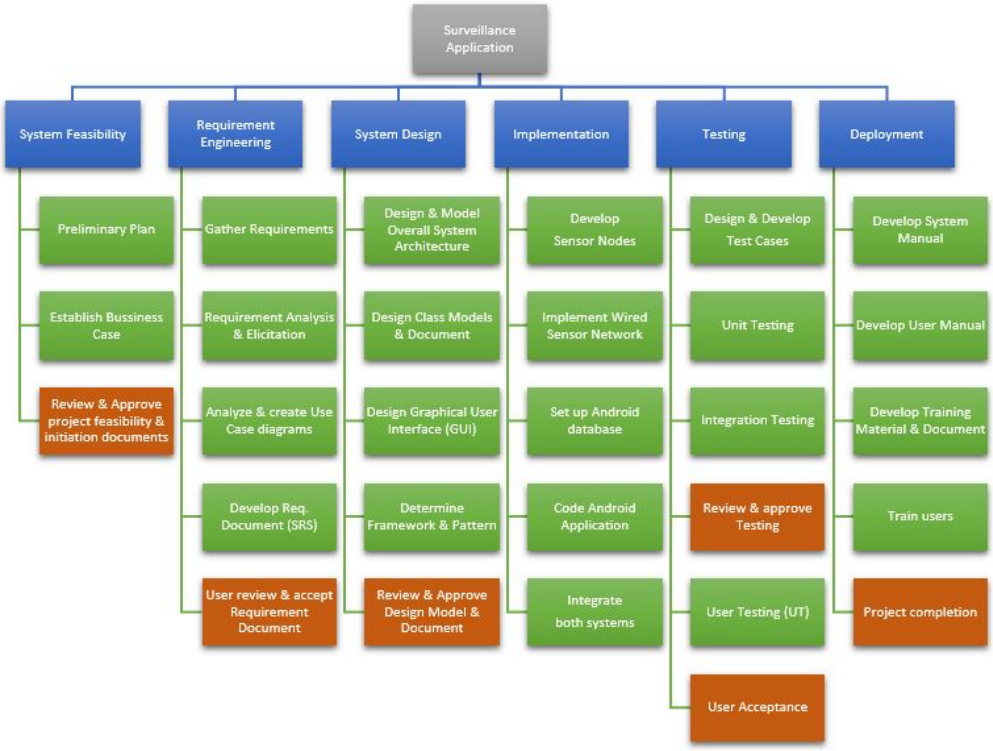


Figure 3 - SAPP: Work Breakdown Structure

4.2 Assumptions and Dependencies

Assuming following things for best working of SAPP:

GSM network should be available in prevailing area and 100% measurements accuracy should not expect from temperature sensor and pulse detector because of the project aim is to develop a prototype

This project contains following software components:

4.2.1 Software Packages

- **Arduino IDE:** It is a development environment to write custom code to Arduino boards.
- **Android Development Tool**: It is an Android Application development platform on Android Devices that allows creation of android application.

4.3 Hardware Components

- **GSM Technology**: It is the medium of connection between the SAPP and its users.
- **Sensors:**
    - PCB for developing a wired network
    - Mini processing unit i.e. Arduino
    - GSM Modules – SIM 900
    - GPS Module
    - Temperature Sensor – LM35

4.4 Architectural Design

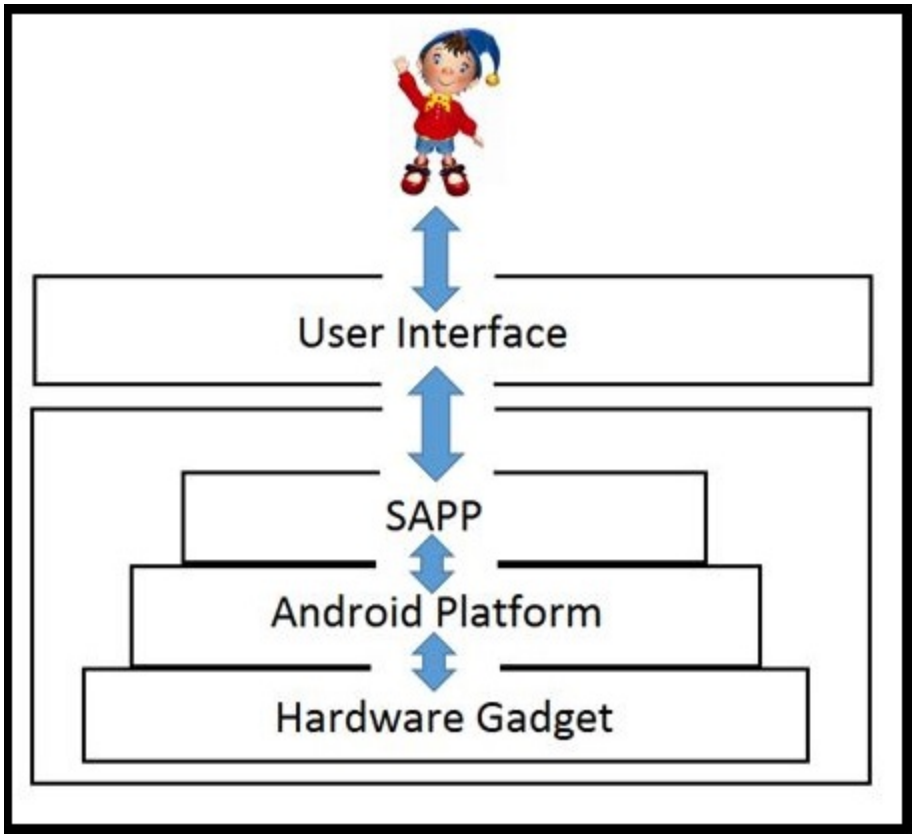


Figure 4 Architecture Design

The system is designed with flexibility for further development and/or modification. The system is divided into manageable processes that are grouped to sub-modules and modules that are built with abstraction.

4.4.1 System Block Diagram

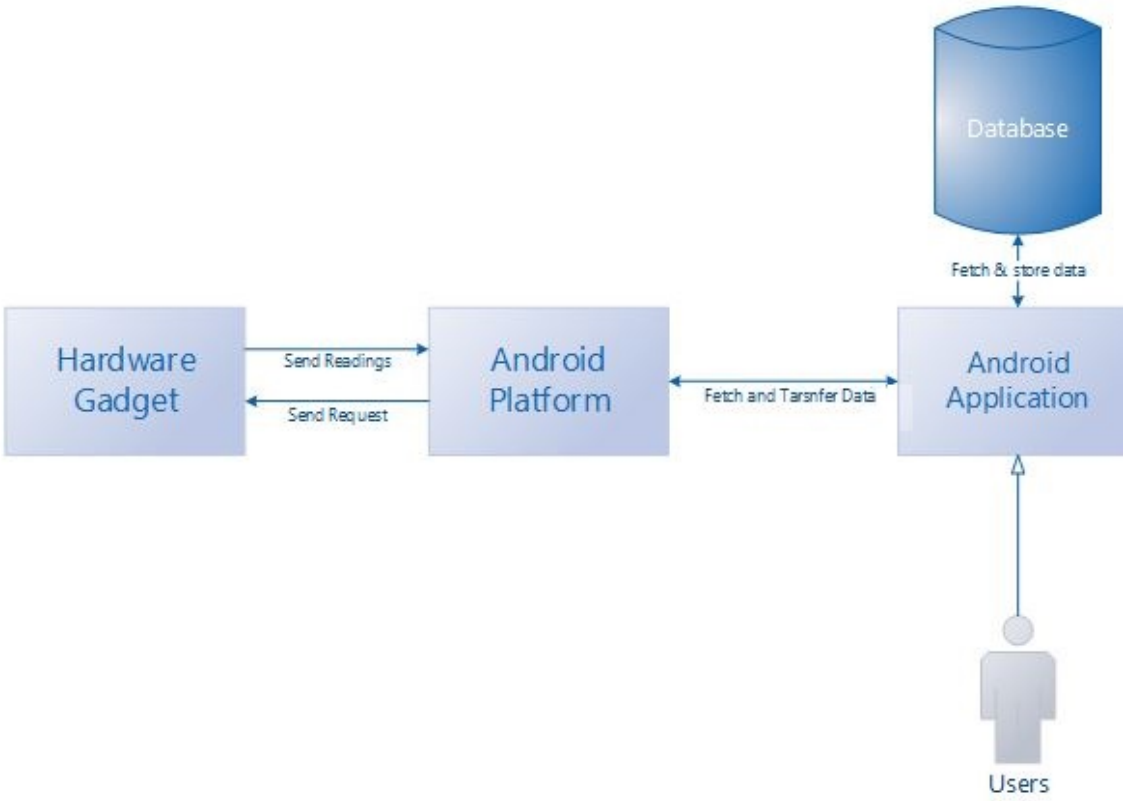


Figure 5 System Block Diagram

4.5 High Level Design Diagram (Modules Identification)

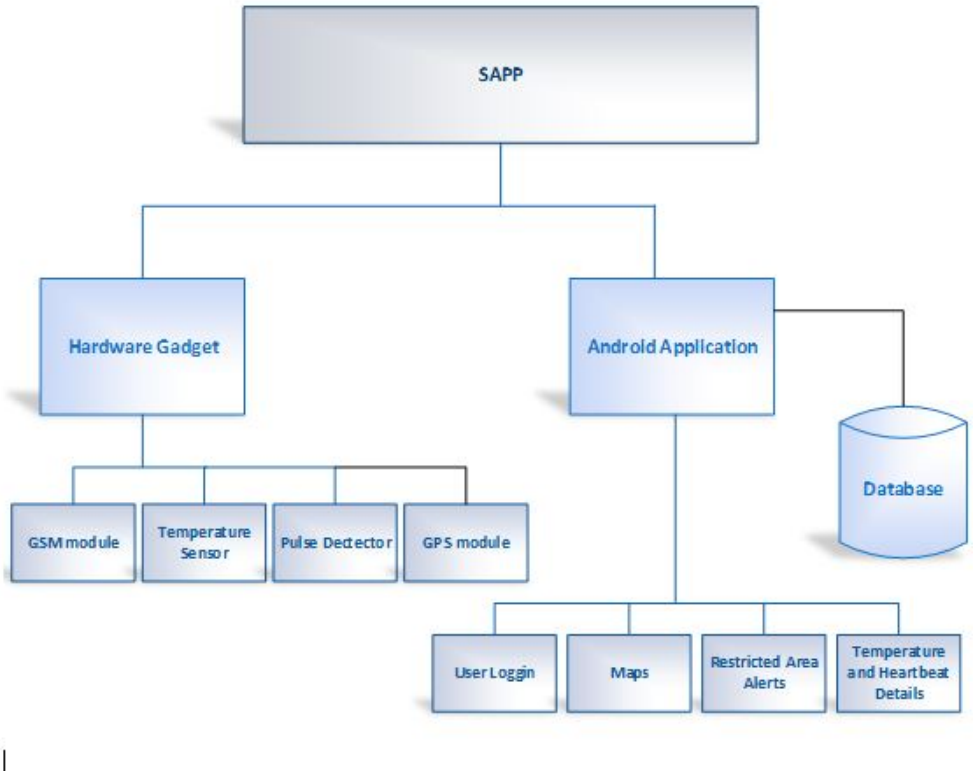


Figure 6 High Level Design Diagram

4.6 Hardware Gadget

First of all by using commercially off the shelf available sensors (e.g. pulse detector, GPS, GSM, temperature sensor) have to be created. Our task is to program the hardware, establish a wired sensor network (WSN) between sensors and processing unit and transmit data to android application after specific time intervals by SMS.

Figure 7 Hardware Gadget

4.7 Android Application

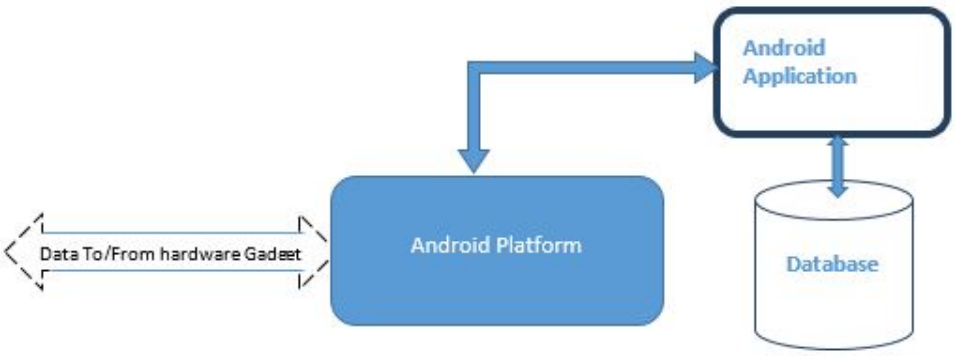


Figure 8 Android Application

Android Application is another module of SAPP, which shall be linked with the database of SAPP. By using this application, common citizens who knows about android shall be able to user themselves with SAPP, so that they can receive location info of secondary user. This application shall also display information on map.

4.8 Architectural Styles

SAPP design uses a number of architectural styles. The architectural style of SAPP not only improves partitioning but also promotes design reuse by providing solutions to frequently recurring problems.

In SAPP following architectural styles are used in the development of system & its subsystems:

- Layered Architecture: for overall development of the system & integration of subsystem.
- Component Based Architecture: for development of Hardware end i.e. Gadget
- Object Oriented Architecture: for development of android Application

The following figure describes the overall architectural style used for designing SAPP:

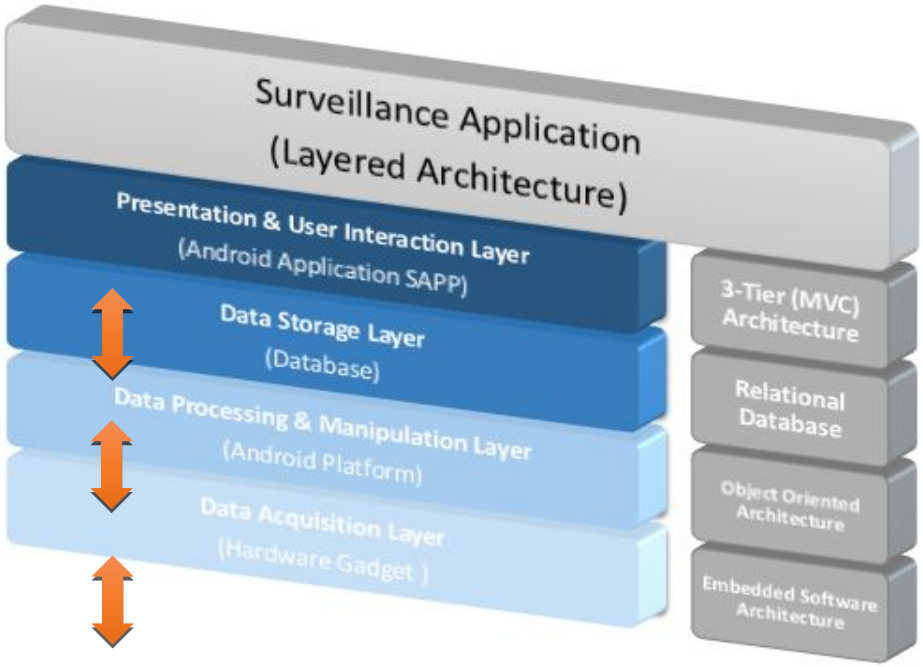


Figure 9 Surveillance Application

4.9 Flow Chart

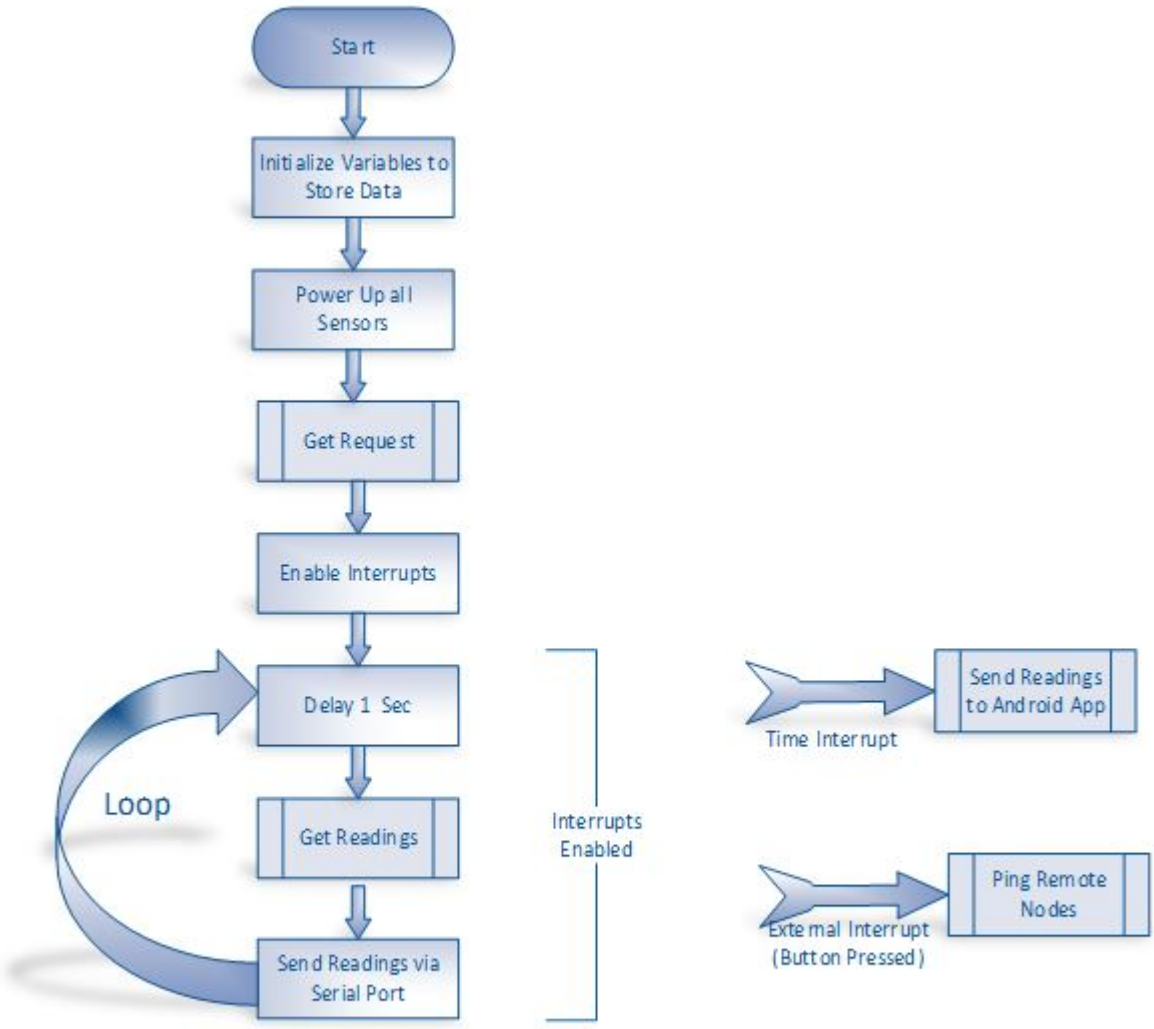


Figure 10 Flow Chart

4.10 UML Diagrams

4.10.1 Use Case Diagrams

4.10.1.1 *Use Case for Application*

The data acquired from hardware gadget is received by the android application. The following use case diagram represents the functionality of this subsystem.

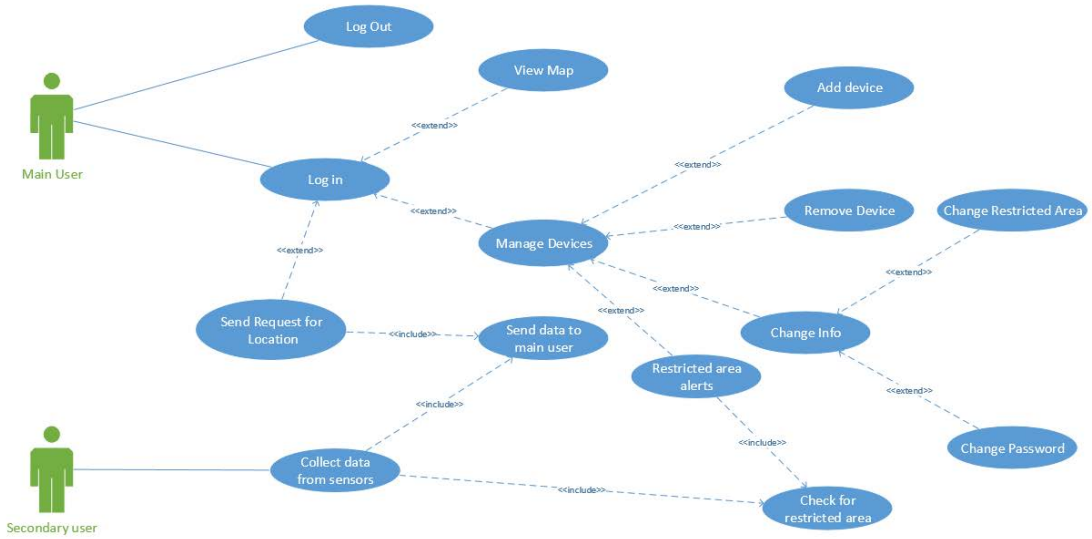


Figure 11 Use Case for Application

UC-1 Establish Network

Use Case Description

The android application shall enable only the primary user to Login using their respective login credentials i.e. by providing their unique user names and the associated password.

Business Justification

Only the android users shall be allowed to have access to this system. The authorized user shall be the only ones who should work on the system.

Description	All sensor nodes (Pulse Sensor, Temperature Sensor, and GPS Module) need to be connected through wire to transfer data. So the mini processing unit in the gadget establishes a mini network to which all the sensor nodes are connected.
Priority	High
Pre-Conditions	All sensor nodes and mini processing unit is turned on
Stimulus/Response	Mini processing unit creates a wired network All nearby sensor connect to the mini processing unit
Post-Conditions	All nodes are connected through a wired network
Risk	Medium

Table 13Establishing Network

UC-2 Fetch Sensor's measurements

Use Case Description

The system receives data from a number of hardware gadget. So the system shall be flexible enough to add new gadgets, edit their information or delete a gadget from menu.

Business Justification

A hardware gadget is the one which sends measurements taken from the sensors to android application. So information of hardware gadget need to be maintained in the database to categorize measurements received from the gadgets.

Description	All sensors (Pulse Sensor, Temperature Sensor, and GPS Module) must acquire real time measurements and this information is stored in the mini processing unit and later on sent to main server.
Priority	High
Pre-Conditions	All sensors are turned on and connected through a wire with mini processing unit.
Stimulus/Response	**Mini processing unit sends fetch command to all sensors one by one** Each sensor replies with the latest acquired measurement. However, if no reply is received for a long time error message is logged instead of storing the measurement.
Post-Conditions	Mini processing unit is updated with the latest measurements from all the sensors
Risk	High

Table 14 Fetch Sensor's Measurement

UC-3 Acquire Current Location of Secondary User

Use Case Description

The application shall always be most of the time in active state to receive data from hardware gadget through SMS. User will login in android application and will send request to take coordinates from hardware gadget through SMS.

Business Justification

Mobile signals are available even in the remotest regions of Pakistan, that's why measurements are received from the hardware gadget via SMS technology.

Description	Main user request for current location of the secondary user. A SMS is sent to the gadget, In response to this SMS the gadget start sending the current location, of the secondary user wearing the gadget, after regular interval. All the measurements are packed into a single SMS and transmitted to the main user.
Priority	High
Pre-Conditions	User need to be Logged in to some android device through valid ID and Password.
Stimulus/Response	**User log in to the SAPP and a SMS is sent to the gadget's mobile no.** Data is packed into a single SMS and is sent to the main user.
Post-Conditions	Gadget starts sending the location after regular interval.
Assumption	If a request SMS is sent to the gadget then the gadget must have received it and behaved accordingly.
Risk	Medium

Table 15 Acquire Current Location

UC-4 Send Measurements To Main User

Use Case Description

Once the application will send request to hardware gadget, in response to that request hardware gadget will send coordinates to application via SMS.

Business Justification

Mobile signals are available even in the remotest regions of Pakistan, that's why measurements are received from the hardware gadget via SMS technology.

Description	The mini processing unit continuously fetches measurements from the sensor nodes (Pulse Sensor, Temperature Sensor, GPS Module) and temporarily stores the real time sensor measurements. These measurements are then packed into a single SMS and transmitted to the main user.
Priority	High
Pre-Conditions	A time interrupt is generated to transmit the measurements or a get measurement request is received from the remote location.
Stimulus/Response	**Data is packed into a single SMS and sent to main user's mobile no.** The gadget does not know whether sever has received the SMS or not.
Post-Conditions	gadget starts fetching again a new set of measurements from the sensors
Assumption	If an SMS is sent to the main user than the main user must have received it.
Risk	Medium

Table 16 Send Measurement To Main User

UC-5 Login – Main User

Use Case Description

The android application shall allow all of its users to login using their respective login credentials i.e. by providing their unique user names and the associated password, in order to get special privilege.

Business Justification

Only the trained and authorized users shall be allowed to have access to certain facilities (described in use case description) of SAPP user manual.

Use Case Name	Login
Actor(s)	Main User
Description	The SAPP application shall enable only the authenticate user to Login using their respective login credentials i.e. by providing the unique gadget's number and the associated password.
Pre-Condition	SAPP application is started, or some previously logged in actor has logged out.
Normal Course	**Login is Successful** • User enters gadget's number • User enters password • User Clicks on Login Button
Post-Condition	User has logged into the system and home screen is displayed
Alternate Course	**Login Failed due to invalid login credentials** • Password field is cleared • Error message is displayed that invalid login credentials are provided
Post-Condition	Login screen is displayed again and user is prompted to enter his/her login credentials again
Assumptions	The SAPP application has been successfully installed in the Android device and users have the valid Login credentials.
Priority	Medium
Risk	Low

Table 17 Login Main User

UC-6 Change Password

Use Case Description

The android application shall allow its users to manually change their login passwords.

Business Justification

In case that the user of android application's password has been compromised, the user himself should be able to change it if he still has access to his account.

Use Case Name	Change Password
Actor(s)	Main User
Description	The SAPP shall allow its users to manually change their login passwords.
Pre-Condition	The Main User has successfully logged into the system and has clicked on change password button on home screen
Normal Course	**Password Successfully Changed** • Enter a valid current password • Enter new password • Enter new password again for confirmation • Click on Change Password button
Post-Condition	Message is displayed that password has been successfully changed and home screen is displayed
Alternate Course	**Invalid Current Password is provided** • User enters invalid current password • User enters new password • User enters confirm new password • User clicks on Change Password **New password entered twice do not match** • User enters a valid current password • User enters new password and confirm new password that do not match. • User clicks on change password button
Post-Condition	Error message is displayed showing the appropriate error message i.e. 'Please enter a valid Current Password' or 'New passwords entered do not match'
Assumptions	Nil
Priority	Low
Frequency	Low
Risk	Low

Table 18 Change Password

UC-7 Manage The Gadgets

Use Case Description

The android application receives data from a number of hardware gadgets. So the system shall be flexible enough to add new gadgets, edit their information or delete a gadgets from the database.

Business Justification

A hardware gadget is the one which sends measurements taken from the sensors to main server. So information of gadgets need to be maintained in the database to categorize measurements received from the gadgets.

Use Case Name	Manage the Gadgets
Actor(s)	Main User
Description	The SAPP shall receive data from a number of gadgets. So the application shall be flexible enough to add new gadgets, edit their information or delete a gadget from the application.
Pre-Condition	User navigates to manage gadgets menu
Normal Course	**Add a new Gadget** • User clicks on Add new gadgets • User enters valid information of the gadgets • User clicks the Add button **Delete Gadget** • User selects a gadget to Delete • User clicks on delete button • User clicks on delete button again when confirmation message is displayed **Edit Information** • User selects a gadget and clicks on change information • All information of gadget is displayed in editable textboxes. • User edits the information and clicks on save button.
Post-Condition	Confirmation Message is displayed i.e. 'A new Gadget Added' or 'Gadget successfully deleted' or 'Information Successfully updated'
Alternate Course	**Gadget already exists**

	User is displayed a message that gadget cannot be added because it already exists. **Information is missed in adding a Gadget** When user clicks add button the textboxes are highlighted, which contain invalid information or information is missed out. **Deletion Failed** If user clicks on No when deletion confirmation message is displayed.
Post-Condition	No changes are done to database and user taken back to Manage Gadgets screen
Assumptions	SAPP's local database is consistent and well maintained and there are no unexpected software error.
Priority	Medium
Frequency	Low
Risk	Medium

Table 19 Mange The Gadgets

UC-8 View Map

Use Case Description

The android application shall display location of gadgets on a map, in order to get a better visualization of distribution of gadgets. Whenever a gadget's location icon is clicked, its information and most recent measurements shall be displayed.

Business Justification

For better visualization of distribution of gadget across and for planning where new hardware are required. Furthermore, in case of entry in restricted areas, map can be used to identify nearby help.

Use Case Name	View Map
Actor(s)	Main User
Description	The SAPP application shall display location of Gadgets on a map, in order to get a better visualization of gadgets. Whenever a gadget icon is clicked, its information and most recent measurements shall be displayed.
Pre-Condition	User clicks on Map button on the main menu
Normal Course	**User clicks on Gadget icon** Information of that gadget is displayed **User moves across the map** Location displayed by the map shall change **User zooms in and zoom out** As per the user action the scale of map displayed changes
Post-Condition	Map is displayed to the user
Priority	High
Frequency	High
Risk	Medium

Table 20 View Map

UC-9 Restricted Area Alerts

Use Case Description
The android application shall indicate when secondary user will enter in restricted areas.

Business Justification
For better visualization of distribution of gadget across and for security. Furthermore, in case of entry in restricted areas, map can be used to identify nearby help.

Use Case Name	Restricted Area Alerts
Actor(s)	Main User
Description	The Mini Processing Unit in the Gadget automatically compares the received measurements from the GPS with the values of restricted areas provided by the main user and generate Restricted Area Alerts. The Main User after logging into the system can view these Alerts.
Pre-Condition	Data is received from a Gadget, and the person wearing the gadget has reached the restricted area or he/she is about to reach.
Normal Course	**User is always prompted with the latest Restricted Area Alerts** • User clicks on Alerts to see its details **User Navigates to Restricted Area Alerts menu** • Alerts are displayed in chronological order • User can specify a time duration to view Alerts generated during that period of time
Post-Condition	Once a particular Alert has been viewed by the Main User it is marked as read.
Alternate Course	No Alerts are available
Post-Condition	A message is displayed that 'No latest Alerts are available' but user can still view old Alerts (if any).
Priority	High
Frequency	Medium
Risk	High

Table 21 Restricted Area Alerts

4.10.2 Sequence Diagrams of key use cases

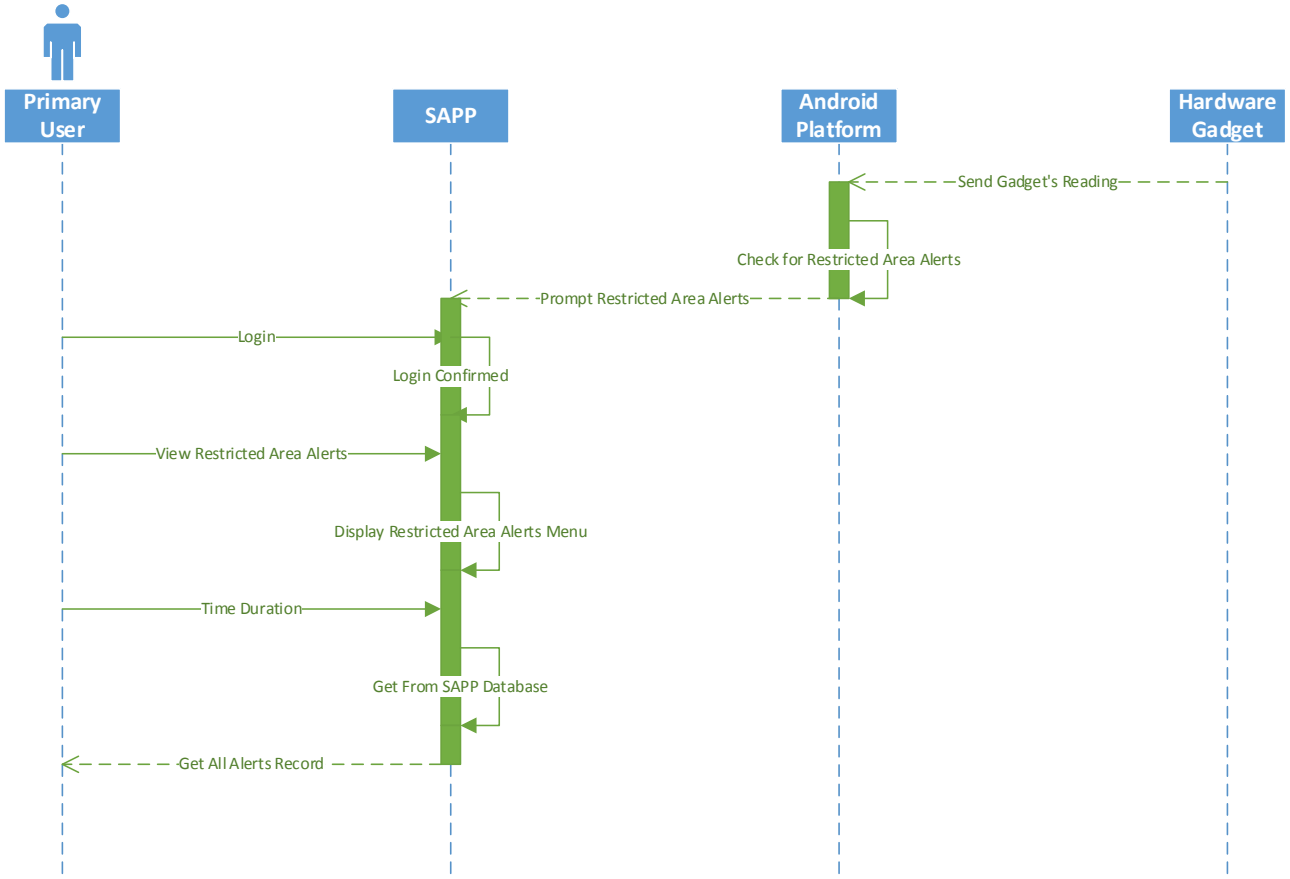


Figure 12 Sequence diagram -restricted Area Alert

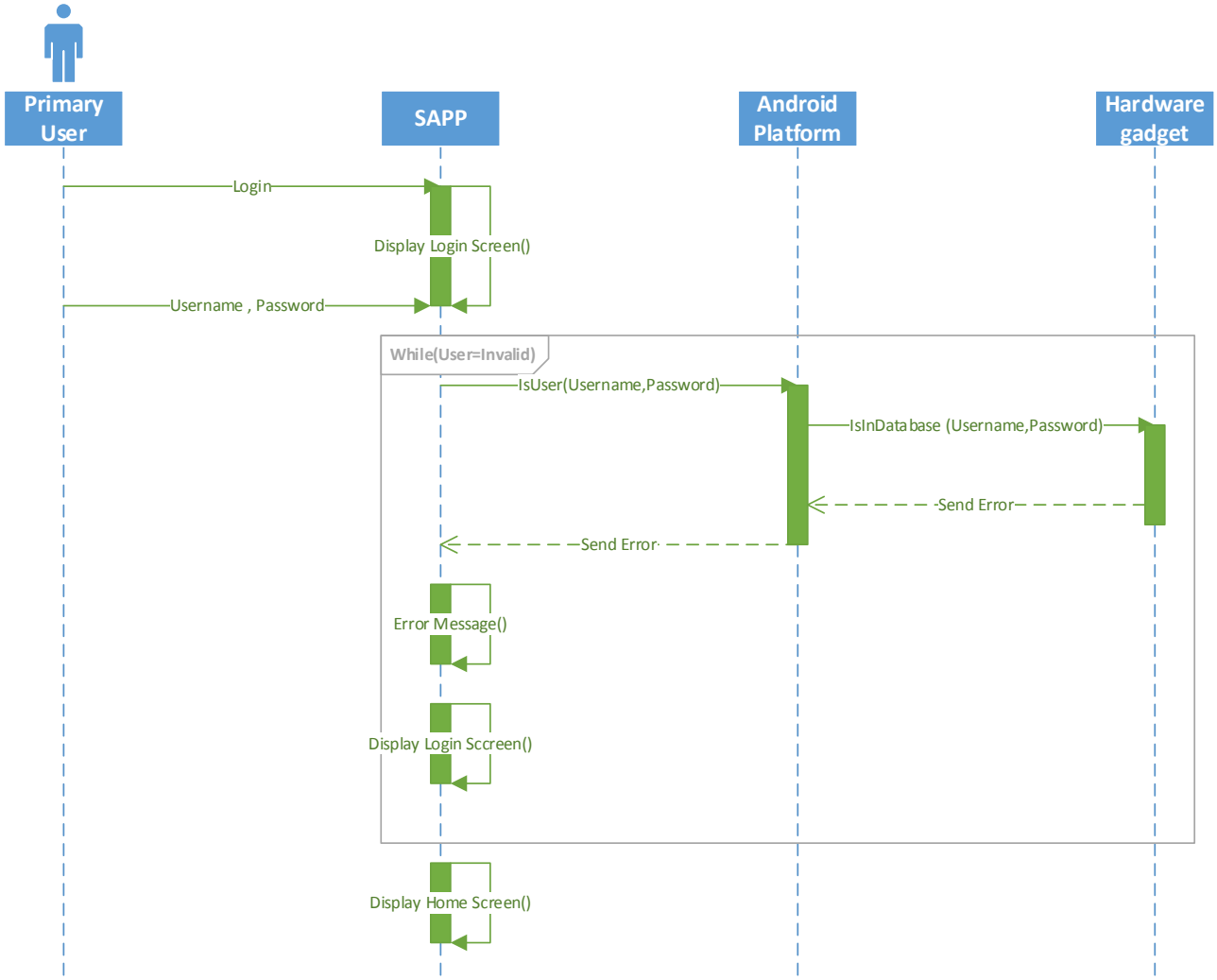


Figure 13 Sequence Diagram - Login

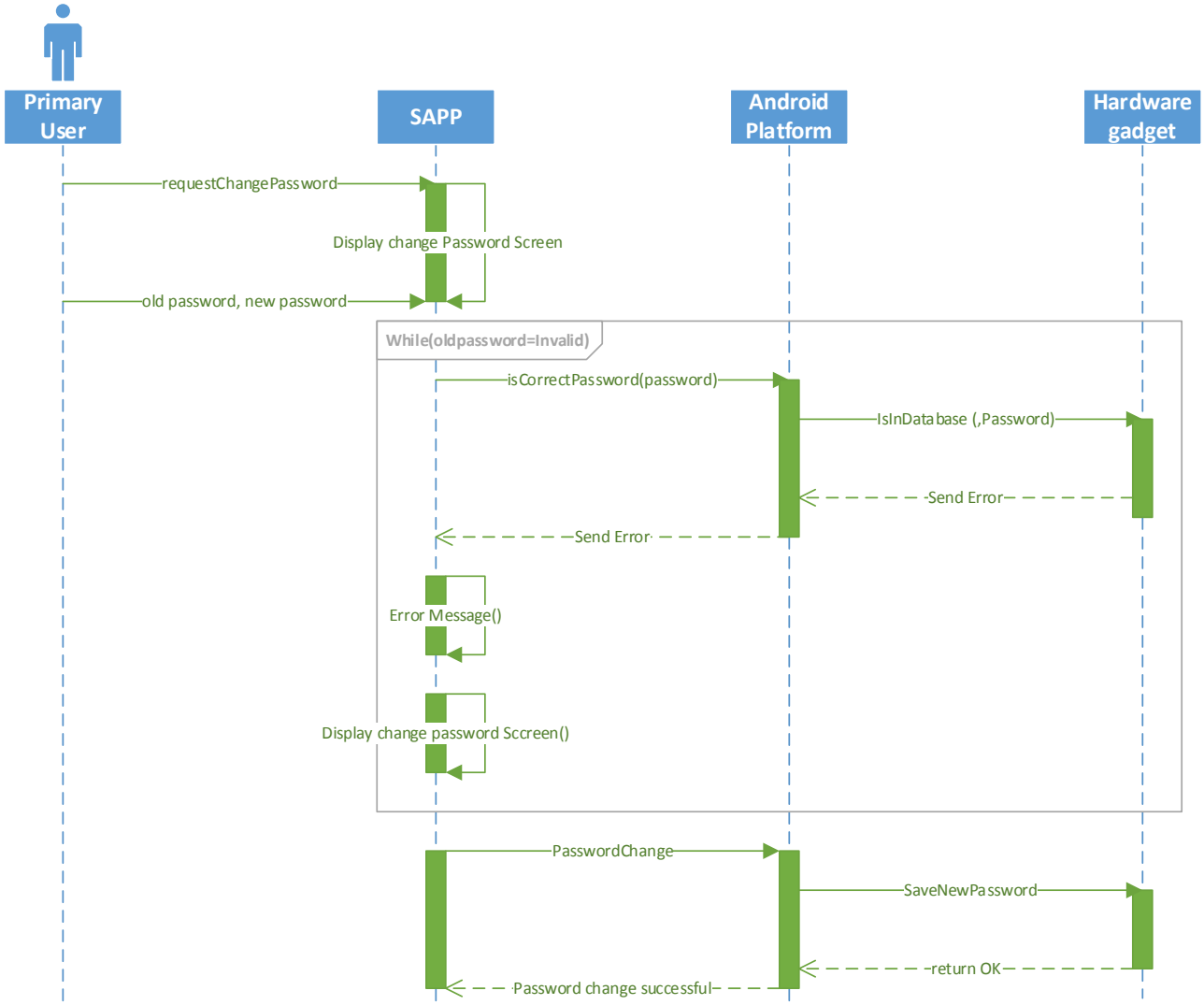


Figure 14 Sequence diagram: Change Password

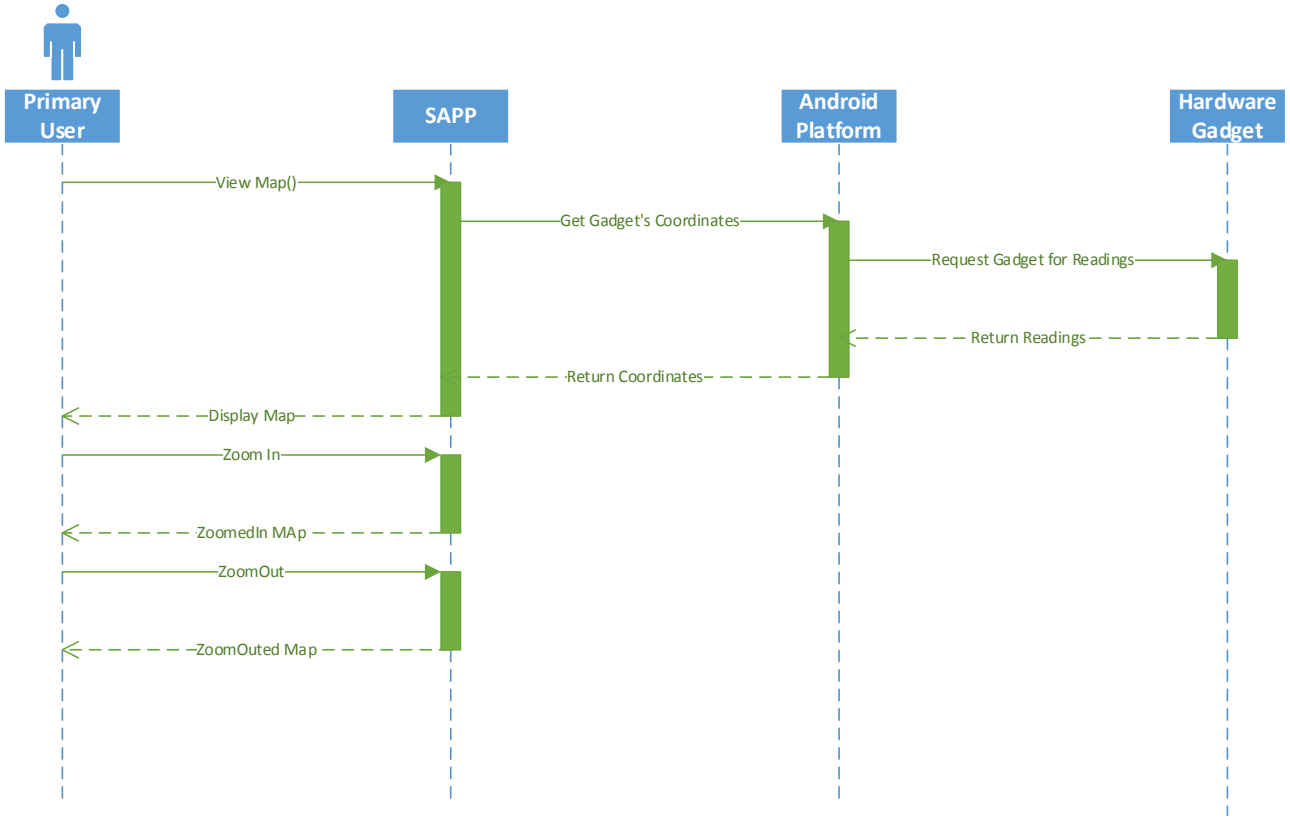


Figure 15 Sequence diagram: View Map

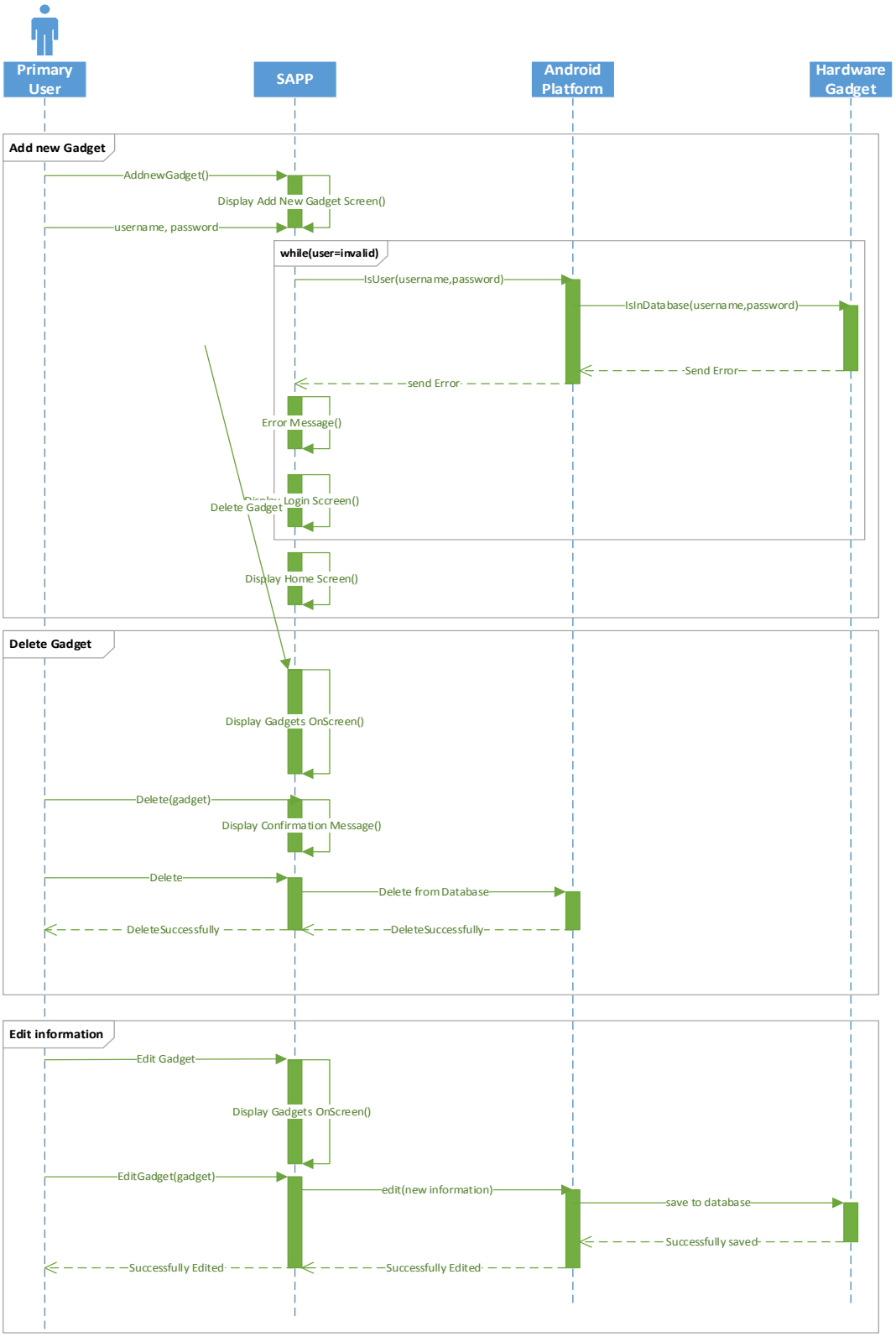


Figure 16 Sequence diagram: Mange Gadget

4.10.3 Activity Diagram

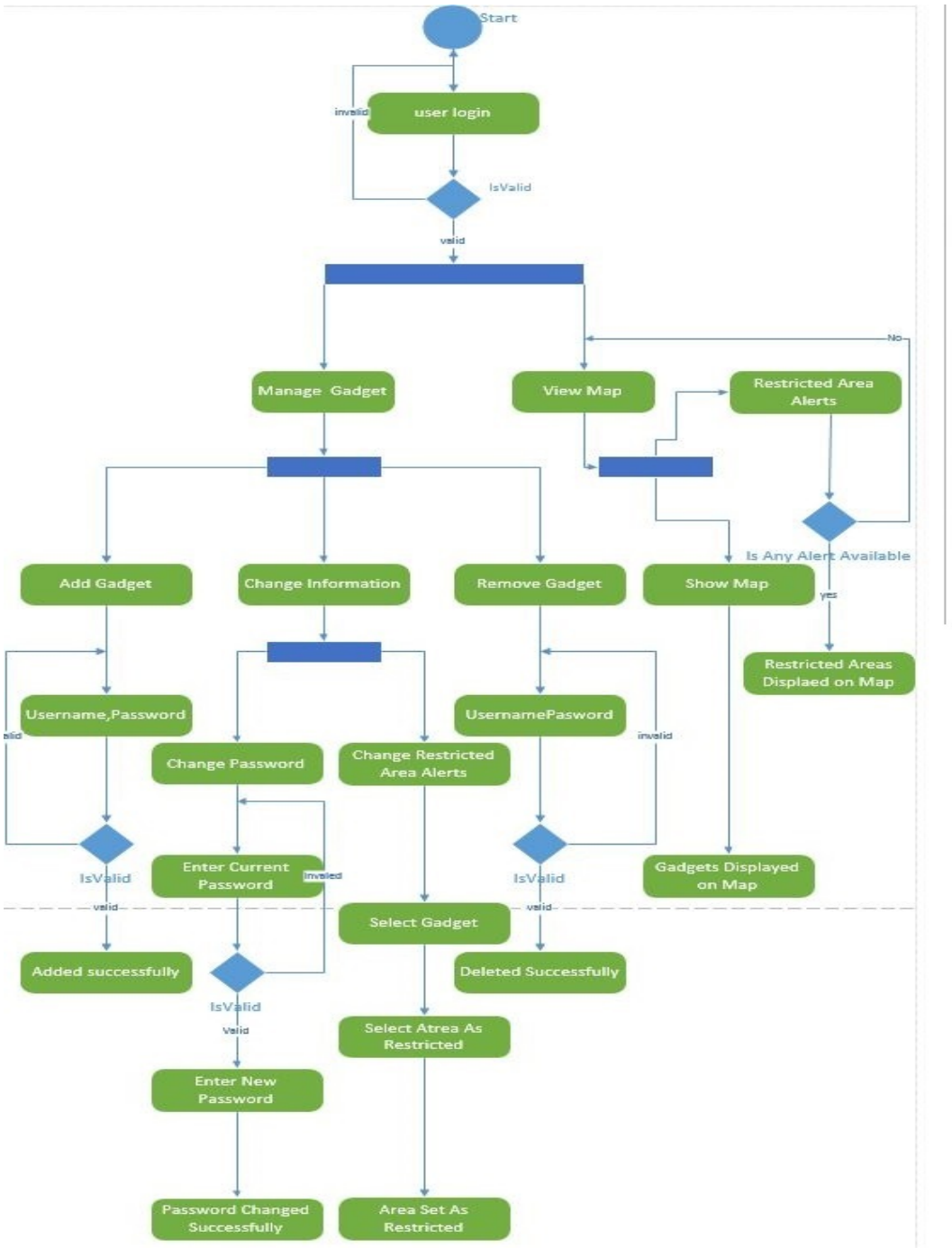


Figure 17Activity Diagram

4.10.4 Class Diagrams

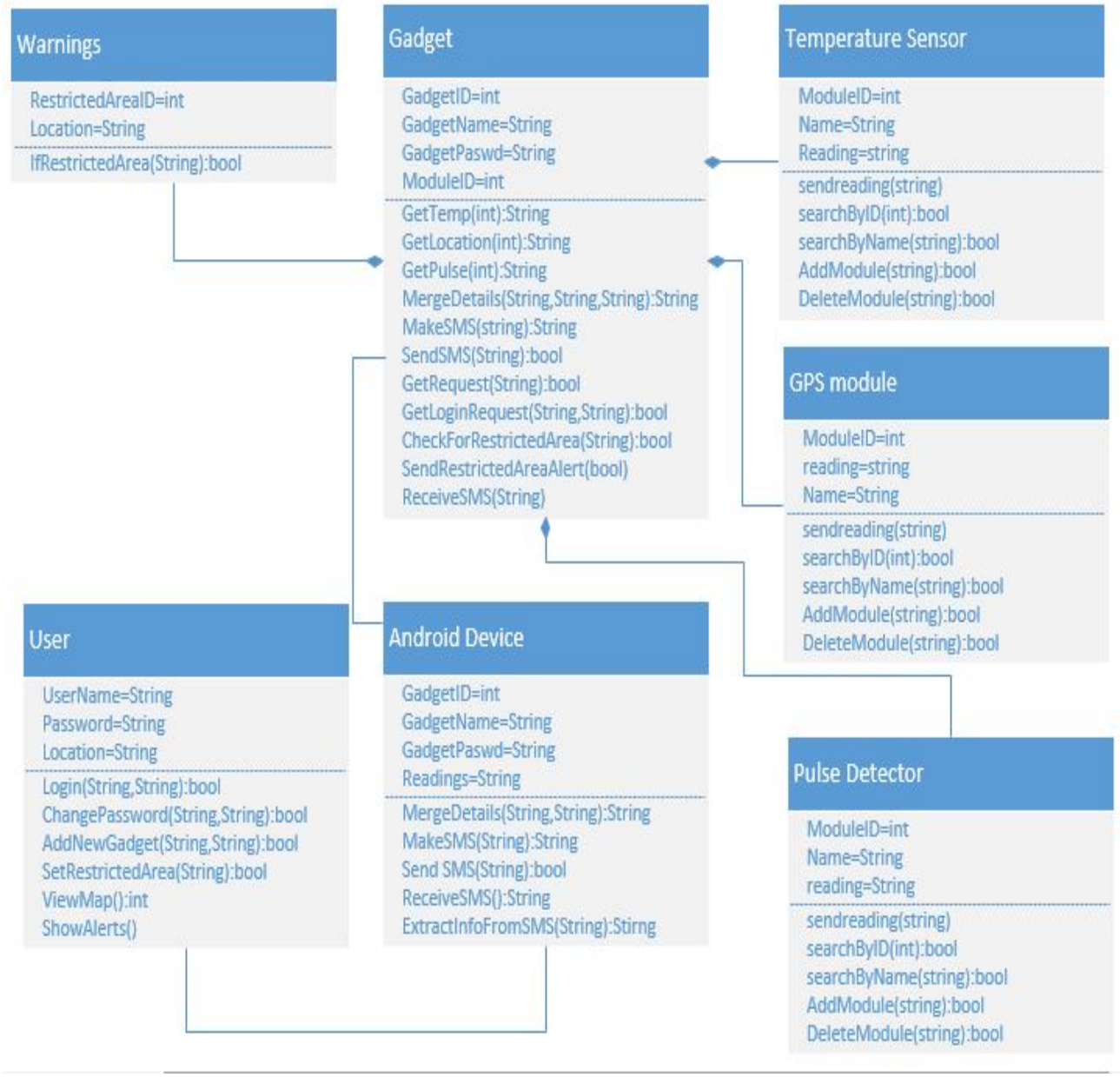


Figure 18 Class Diagram

4.11 User Interfaces

Firstly, in order to view real-time measurements from the sensors, an LCD shall be used. This LCD shall be attached with the mini-processing unit to display the readings directly coming from the sensors.

Secondly, the android based application shall be an android form based java application, which shall provide a graphical user interface for user friendly environment. All the data entry shall be done with keypad and the user can navigated between menus/form/screens with the help of keyboard and mouse both.

Finally, the user interface for the android application of SAPP shall be compatible to all android devices but for best user experience the following versions are preferable

- Jelly bean 4.1.2
- ICS 4.1.1

The Screenshots for SAPP user interface are as follows:

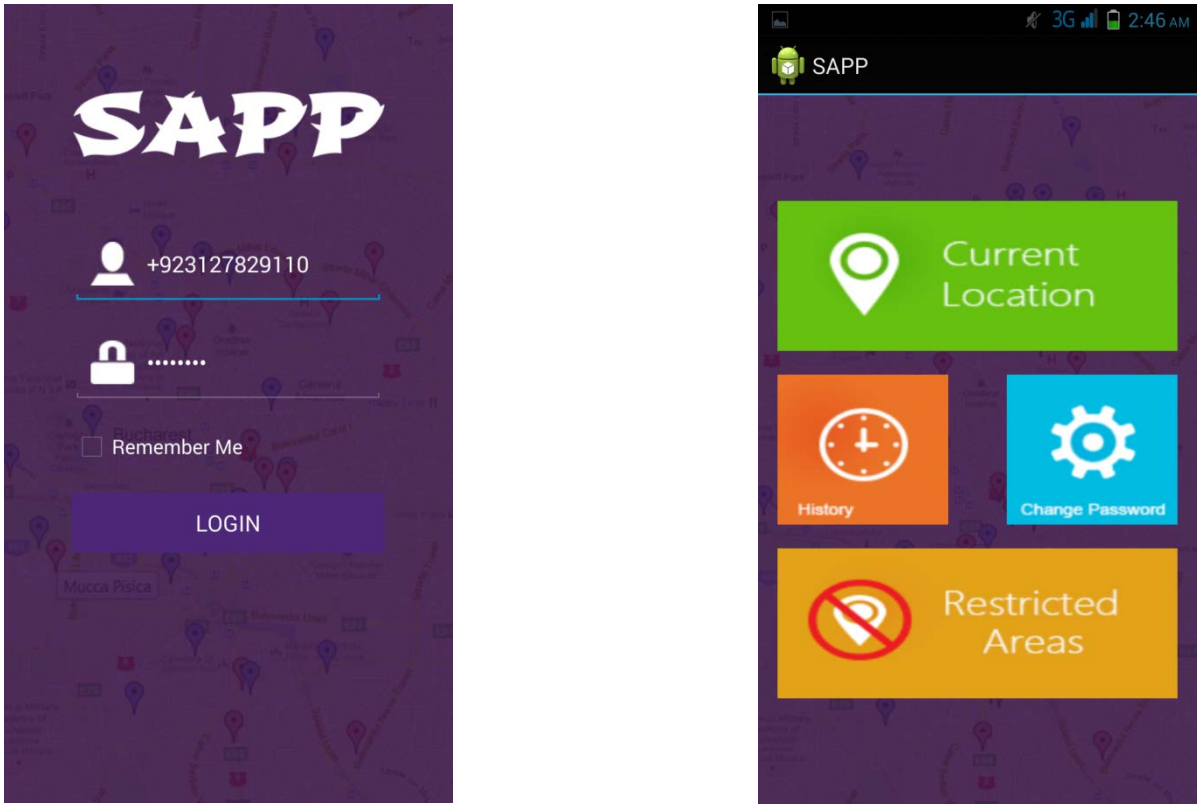
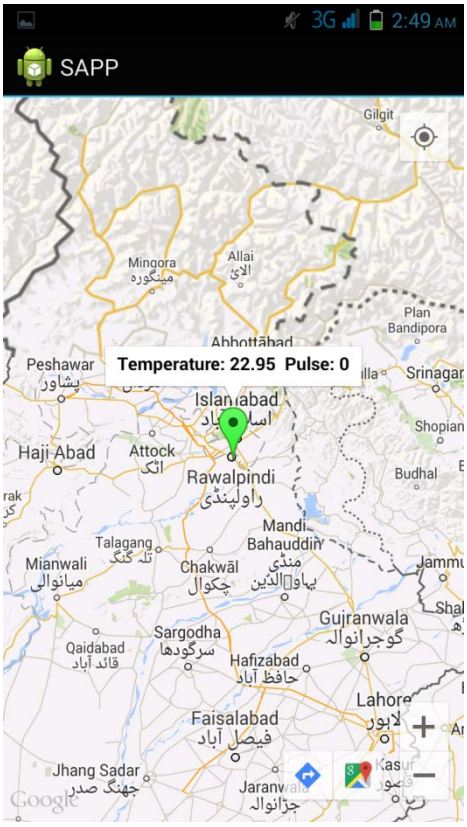


Figure 19 User Interface



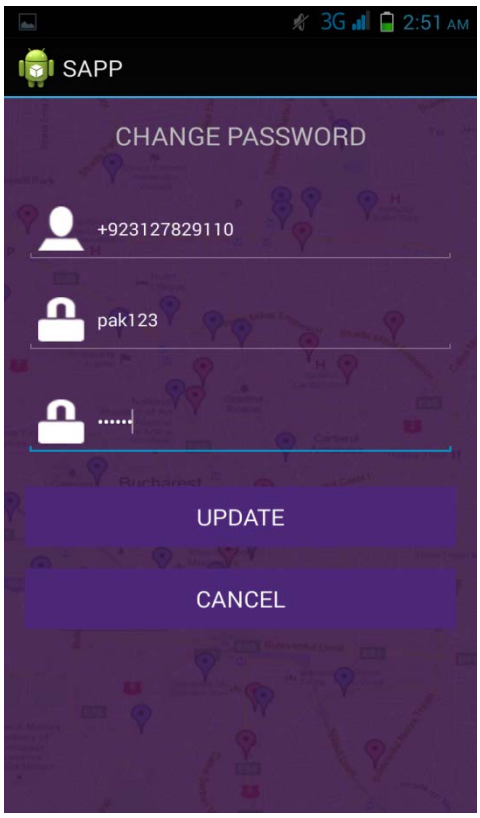


Figure 20 User Interface

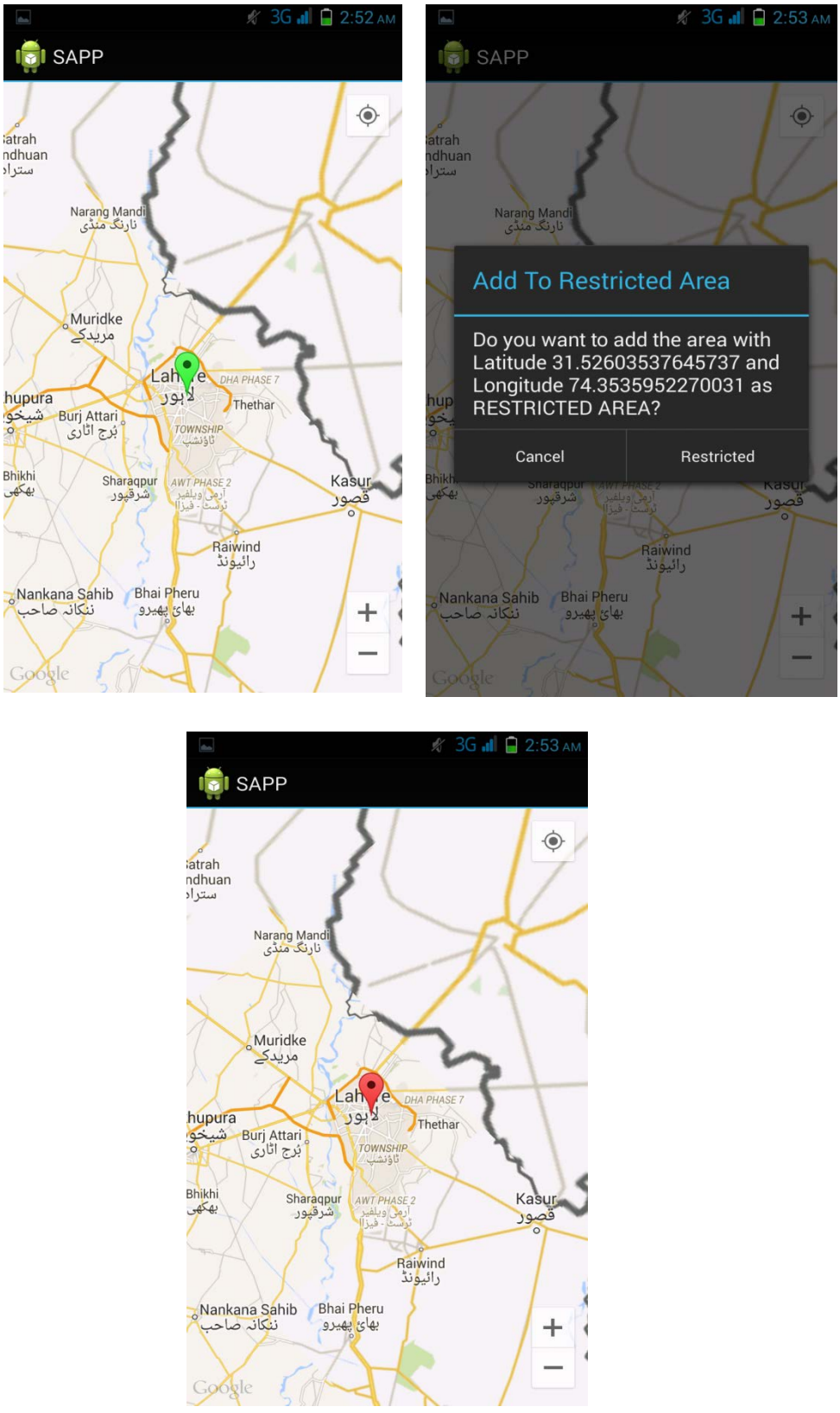


Figure 21 User Interface

4.12 Hardware Interfaces

Sensors are connected through wire with the mini processing unit. Arduino module is used to establish a network between the sensors in a gadget. The modules communicate with Arduino board via serial communication.

Furthermore, communication between Gadget and Android devices done by using the GSM module. The measurements are packed in an SMS and transmitted to the main user and vice versa.

Similarly, GPS module is attached with the mini processing via serial port to acquire global GPS coordinates. The data received via GPS module uses NMEA protocol, so GPS coordinates have to be extracted from the protocol packet.

In addition to other sensors temperature sensor is also connected with the mini processing unit and temperature is measured from the temperature sensor via analog pin of Arduino board (mini processing unit).

4.13 Software Interfaces

- System shall be installed on android device with version of ICS and latest to it.
- The android application shall be developed using Java on eclipse.
- For this application a number of API and external Libraries shall be needed i.e.
  - GMAP API, Google map API shall be used to display maps
  - Serial communication library shall be used to communicate with GSM Module.
- SAPP android application shall accessible on any android device connected through GSM.

4.14 Communications Interfaces

- All sensors in gadget are interconnected and finally managed by mini processing unit.
- For Communication between Gadget and android application, Short Message Service (SMS) of GSM technology is used. Each gadget is identified by its unique contact number.
- The android application of SAPP system shall use Google map to show location of secondary user.

4.15 Pseudo Code

```
Login(id,password)

        //IF (credentials=Correct)

                Proceed

        Else

                Try again


Add_gadget()

        //input gadget id and password

Remove_gadget()

        //input gadget id and password you want to remove

Change_info()

        //display the screen which gives option to change password and restricted area

Change_password()

        //provide the present password and the new password to change the password
```

Change_restricted_area()

//input the coordinates so that the app will alert when the gadget is in those areas

Display_map()

//display the location of all the gadgets on different maps using GPS.

Temp_sensor()

//shows the temperature of the environment of the gadget

Pulse_detector()

//informs whether the gadget has been put on or not. In case of removal it will send an alert to the user on sms.

CHAPTER:5

5 SYSTEM IMPLEMENTATION

The implementation of SAPP is carried out in three phases. Firstly, the development and coding of hardware end i.e. Gadget. Secondly, the development of Android application and finally the integration of both.

5.1 Implementation of Hardware Gadget

The programming of the (microcontroller) in the Gadget is carried out using the Arduino IDE and functional approach has been adopted as described in the design phase. The key implementation details are briefly described as follows:

5.1.1 Measuring Pulse Rate

In order to measure Pulse Rate of the person wearing the gadget a pulse sensor is used. Every time a pulse is received the sensor sends an echo to the microcontroller and the pulse rate is calculated by taking the time difference between two echoes.

5.1.2 Measuring Temperature

In order to measure the temperature a temperature sensor is used. For measuring temperature LM35 analog temperature sensor is used. It represents change in temperature from 0 to 100 ^{o}C with a voltage change from 0 to 1 v.

Formula: Temperature = (Sensor Value * 500) / 1024

At No-3 is the Temperature sensor shown in the diagram.

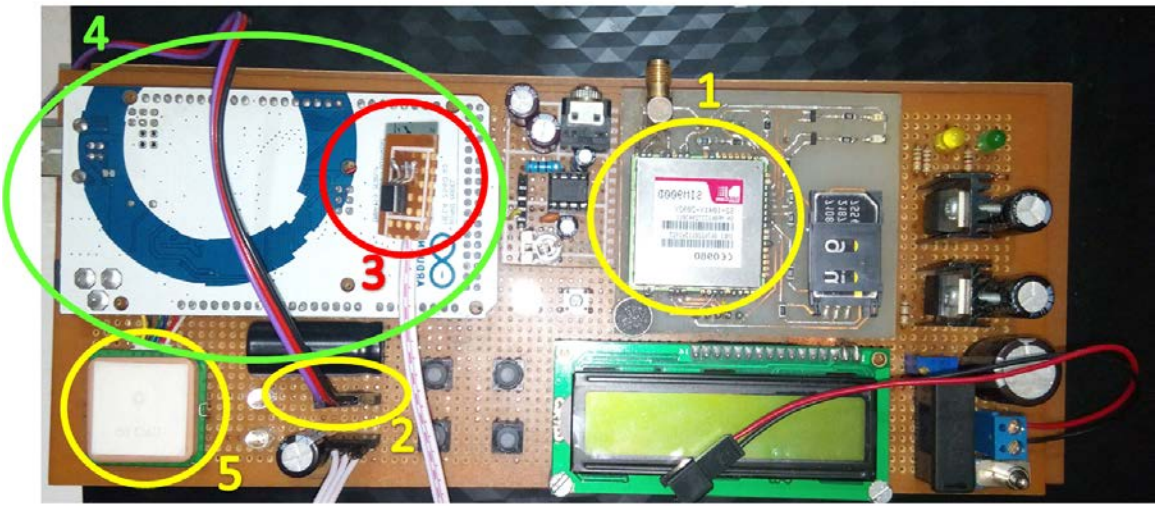


Figure 22 Temperature Sensor

5.1.3 Mini Processor

The mini processor is the central processing unit of the gadget. Its job is to collect sensor measurements, compile them and send it to the main user via SMS.

The code for the mini processor is as follows:

5.1.3.1 *Code*

Temperature working

```
float getTemperature()
{float temp=analogRead(A2);
 temp=temp*500/1024;
 //temp=temp/9.31;
 if(temp>0 && temp<100)
```

```
{ if(TempMode)
  { Temperature=temp;
    return temp;}
  else
  {return ((temp * 9/5) + 32) ;}}
return -1;}
```

GPS Working

```
boolean getGPS(volatile double& lattitude,volatile double& longitude)
{  char c;
  while(Serial2.available())
  {
    c = (char)Serial2.read();
    gpsInputString += c;
    if(c=='\n')
    {                                                    gpsInputString                    =
gpsInputString.substring(gpsInputString.lastIndexOf("$GPGGA"),42);
      int strLength = gpsInputString.length();


      if(gpsInputString.startsWith("$GPGGA") && strLength==42)
      {
        String lat = gpsInputString.substring(18,27);
        double lat_degree = lat.substring(0,2).toInt();
        char ary[8];
        lat.substring(2,9).toCharArray(ary,8);
        double lat_minutes = atof(ary);


        String lng = gpsInputString.substring(30,40);
```

```
double lng_degree = lng.substring(0,3).toInt();
lng.substring(3).toCharArray(ary,8);
double lng_minutes = atof(ary);

lattitude = lat_degree + lat_minutes/60;
longitude = lng_degree + lng_minutes/60;

int hrs = gpsInputString.substring(7,9).toInt();
hrs=(hrs+5)%24;

String
time=(String)hrs+':'+gpsInputString.substring(9,11)+':'+gpsInputString.substring(11,13);
if(hrs<10)
  Time="0"+time;
else
  Time=time;
//Serial.println(Time);
//Serial.print("lat: "+lat);Serial.println("  long: "+lng);
//Serial.println(gpsInputString);
//Serial.print("Lattitude: ");Serial.println(lattitude,8);
//Serial.print("Longitude: ");Serial.println(longitude,8);
```

```
      //Serial2.flush();
      gpsInputString="";
      return true; }
  gpsInputString="";}}
return false;}
```

SMS Working

```
void sendSMS(String msg)
{ Serial1.print("AT+CMGF=1\r"); // AT command to send SMS message
  delay(300);    // Serial1.println("AT+CMGS = \"" + BaseUnitNo + "\"");  // Reciepient's mobile number, in international format
  delay(300);
  Serial1.print(msg+"ID: 001\nTemperature: ");
  Serial1.print(Temperature,2);
  Serial1.print(" C\nPulse Rate: ");Serial1.print(BPM);
  Serial1.print("\nLattitude: ");
  Serial1.print(lattitude,8);
  Serial1.print(" N\nLongitude: ");
  Serial1.print(longitude,8);
  Serial1.print(" E\nTime: ");
  Serial1.print(Time);
  delay(200);
  Serial1.println((char)26);                    // End AT command with a ^Z, ASCII code 26
  delay(200);
  Serial1.println();
  //Serial.println("Message Sent\n"+no+"::"+msg);
  smsSendTime=millis()+60000;}
```

5.1.3.2 Hardware Description

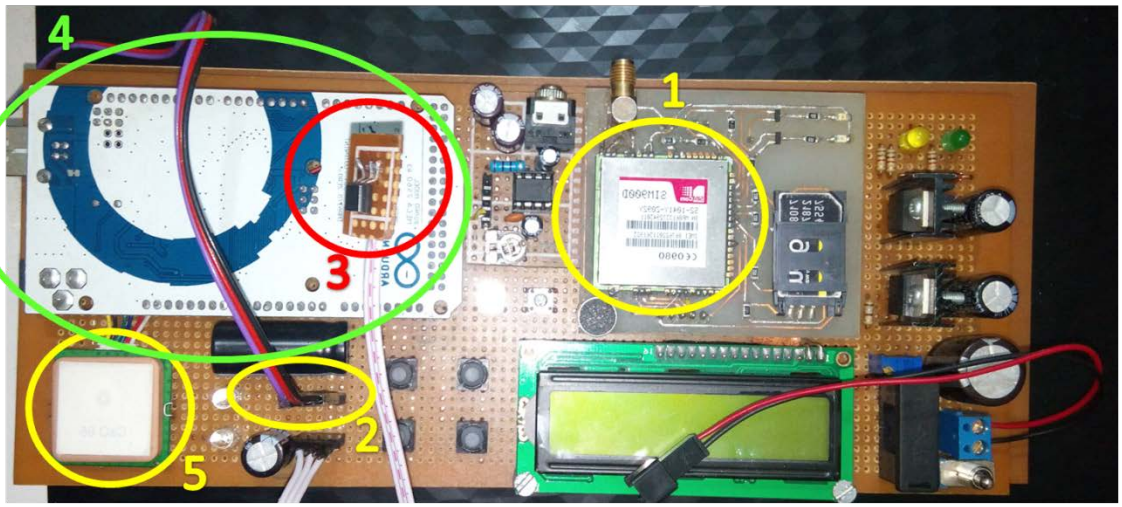


Figure 23 Detailed Circuit Diagram

i. SIM 900 GSM Module
ii. Pulse sensor
iii. LM35 Temperature Sensor
iv. Arduino mega 2560
v. SKM53 GPS Module

5.2 Implementation of Android Application

Android application has been implemented as per described in the designed phase. That is using Eclipse JDK version 1.7 and JAVA programming language as defined in system design specification.

The total implemented code of this application consists of more than 2000 lines so to keep the document concise code details are not being included. So, the following screen shots of the server application are being included in order to show the actual implementation of the Android application.

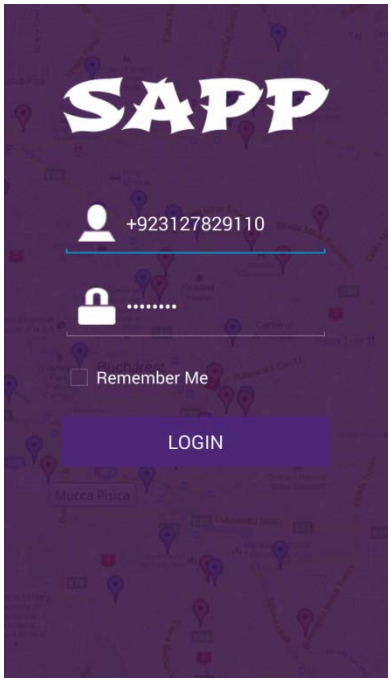


Figure 24 Login

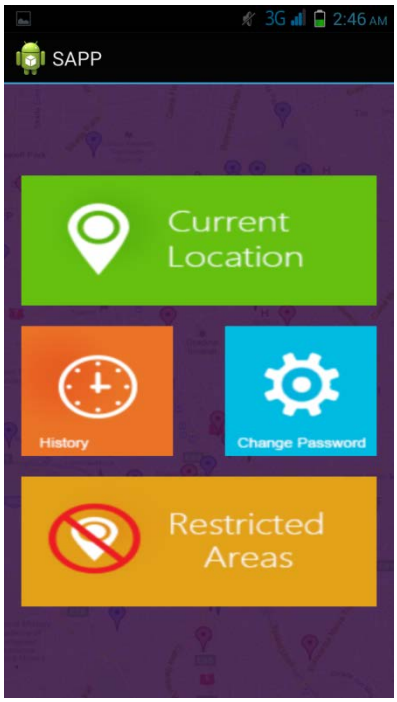


Figure 25 Main Menu

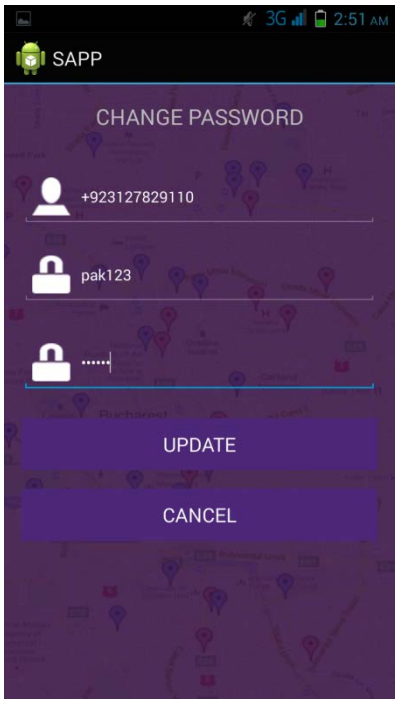


Figure 26 Change Password

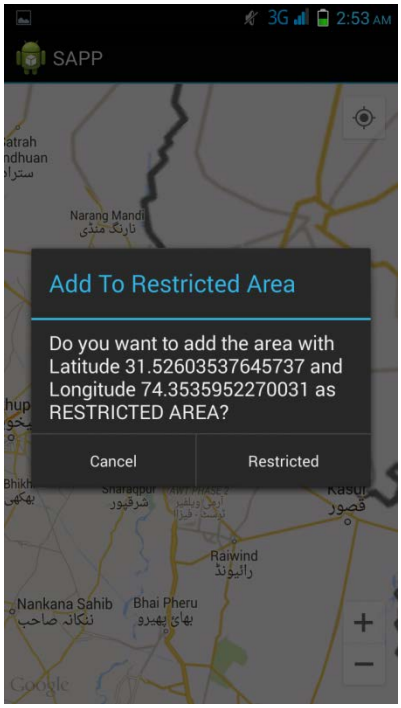


Figure 27 Restricted Area

CHAPTER:6

6. System Testing

6.1. Overview

Testing of the software projects involve different levels of testing to make sure that the software which is being developed is error and fault free. Cloud based Unified IDE for .NET Languages has different modules which were developed separately depending up on the functionalities. Therefore testing of all the modules has to be done and testing while integrating all the modules. The different levels at which testing was done are discussed here.

6.2. Approach

No tool is used to test the application. Code is tested on Eclipse and the features are tested on the running application.

6.3. Test Cases

6.3.1. Login Testing

Test Case Name	Login
Test Case ID	1
Description	The first step to use this Application is that user needs to be logged in to the Application using valid credentials. And this feature allow the authorize user to get into the Application
Testing Technique used	Black Box Testing
Preconditions	Application is installed on mobile phone and user has valid credentials
Input Values	Mobile Number & Keywords

Valid Inputs	Mobile Number format should be "+920123456789" and password can be letters, numbers, symbols and combination of all these. But no spaces
Expected output	User should be taken to the screen of Main Menu
Actual output	Main Menu screen was available to the User
Status	PASS

Table 22 Login Testing

6.3.2. Check Current Location Testing

Test Case Name	Check Current Location
Test Case ID	2
Description	This feature allows the main user to check for the current location of secondary user and if not available then it shows the last received location.
Testing Technique used	Black Box Testing
Preconditions	User is logged in to the Application using valid credentials
Input Values	Touch the screen
Valid Inputs	"Current Location" icon is touched
Expected output	Latest location of the gadget (secondary user) is displayed on the Map
Actual output	User got the latest location of the gadget on Map in the form of a pointer on Map
Status	PASS

Table 23 Check Current Location Testing

6.3.3. Check Details Testing

Test Case Name	Check Details
Test Case ID	3
Description	This feature enables the user to check the other details i.e. (Temperature, Pulse Rate)
Testing Technique used	Black Box Testing
Preconditions	The current location pointer is visible on the Map
Input Values	Touch the current location pointer on Map
Valid Inputs	User has touched the screen right on the location pointer
Expected output	Temperature and pulse rate details should be displayed to the user
Actual output	Temperature and pulse rate details were available to the user
Status	PASS

Table 24 Check Details Testing

6.3.4. Check History Testing

Test Case Name	Check History
Test Case ID	4
Description	This feature allows the user to check all the places where the person wearing the device has been previously
Testing Technique used	Black Box Testing
Preconditions	User is logged in to the Application using valid credentials
Input Values	Touch the screen
Valid Inputs	“History” icon is touched
Expected output	The previous locations of the person wearing gadget are displayed
Actual output	The previous location were displayed
Status	PASS

Table 25 Check History Testing

6.3.5. Change Password Testing

Test Case Name	Change Password
Test Case ID	5
Description	This feature allows the user to change the password, used for login
Testing Technique used	Black Box Testing
Preconditions	User is logged in to the Application using valid credentials
Input Values	Touch the screen
Valid Inputs	“Change Password” icon is touched
Expected output	Change password screen is displayed and password is changed after providing the valid information
Actual output	Change password screen was displayed and password was successfully updated when the user provided new password
Status	PASS

Table 26 Change Password Testing

6.3.6. Set Restricted Area Testing

Test Case Name	Set Restricted Area
Test Case ID	6
Description	This feature allows the main user to set any area as restricted area for the secondary user
Testing Technique used	Black Box Testing
Preconditions	User is logged in to the Application using valid credentials
Input Values	Touch the screen
Valid Inputs	“Set Restricted Area” icon is touched
Expected output	Any area which user selects on map is set as restricted area
Actual output	Area selected by user was set as restricted area
Status	PASS

Table 27 Set Restricted Area Testing

6.3.7. Restricted Area Alerts Testing

Test Case Name	Restricted Area Alerts
Test Case ID	7
Description	This feature allows the user to get the notifications of restricted area alerts when secondary user goes to some restricted area
Testing Technique used	Black Box Testing
Preconditions	Android device is an and secondary user goes to some restricted area
Input Values	Coordinates received from gadget
Valid Inputs	Coordinates matches with those set as restricted area
Expected output	A restricted area alert notification should appear in mobile's notifications area
Actual output	A notification was appeared when the secondary user went to a restricted area
Status	PASS

Table 28 Restricted Area Alerts Testing

6.3.8. Time Display On Gadget Testing

Test Case Name	Time Display on Gadget
Test Case ID	8
Description	Gadget will display the time on LCD attached with it
Testing Technique Used	Black Box Testing
Preconditions	Circuit is turned on and GPS is working properly
Input Values	String received from GPS
Valid Inputs	Only time is separated from the string and is sent to the LCD for display
Expected Output	Exact time, after adding 5 hours and 30 minutes in standard time received from GPS, is displayed on LCD
Actual Output	Correct time was being displayed on the LCD
Status	PASS

Table 29 Time Display On Gadget Testing

6.3.9. Temperature Display on Gadget Testing

Test Case Name	Temperature Display on Gadget
Test Case ID	9
Description	Gadget will display the temperature on LCD attached with it
Testing Technique Used	Black Box Testing
Preconditions	Circuit is turned on and Temperature sensor is working properly
Input Values	Temperature values received from the sensor
Valid Inputs	The temperature range is between 0-100 C
Expected Output	Temperature should be displayed on the LCD
Actual Output	Temperature was displayed on the LCD
Ststus	PASS

Table 30 Temperature Display on Gadget Testing

6.3.10. Pulse Rate Display on Gadget Testing

Test Case Name	Pulse Rate Display on Gadget
Test Case ID	10
Description	Gadget will display the pulse rate on LCD attached with it
Testing Technique Used	Black Box Testing
Preconditions	Circuit is turned on and pulse detector is working properly
Input Values	Pulse value of the person wearing the gadget
Valid Inputs	The pulse detector is properly attached to the person's body
Expected Output	The pulse rate of the person wearing gadget should be displayed on the LCD
Actual Output	The pulse rate of the user wearing gadget was displayed on the LCD when pulse detector attached to his body
Status	PASS

Table 31 Pulse Rate on Gadget Testing

CHAPTER:7

7 FUTURE WORK

SAPP is basically an idea that can be used for surveillance of assets that can be in the form of human or other than that. Our gadget volume is little bit large than expections to carry in fact and if it's applied on kids, that will affect by the psychological effect that I am being tracked all the time.

In future its volume can be minimized to form a proper hidden device that can be used to track people or assets. It can be embedded in a watch that can be necessary to carry by kids as well as employees in an organization that would transmit the heartbeat and temperature of place the person in. To carry forward our project, if the size of circuit is minimized that can have less consumption of energy and thus will be easy to carry by any person. Locks can also be implemented to save the assets. When the lock opens, it will transmit signal and will inform the owner that particular asset is at risk.

Phone call feature can also be added that kid or employee can receive and make call with only one button, that will offer one click communication to secondary user and no more complications are involve to dial number and memorize number, because one particular and emergency number is already saved in gadget and can be initiated with one button only.

CHAPTER:8

8 CONCLUSION

8.1 Overview

Surveillance Application is not just a final year project of an engineering degree but it was the passion of the group to work on something as to solve the problems of our society. It is not just a project but an urgent NEED for our society.

There are applications in a number of foreign countries which serve the same purpose but the issue is the extremely high cost and different deployment scenario of this system in our project. So that's why a dedicated system for monitoring and surveillance was required for our society. As we know the tragic incident happened in Peshwar APS, and parents were much more worried about their children once they heard the news, no one knew that where their child is. If they would have been using this application they could easily detect where their child is and either he or she is alive or dead.

8.2 Objectives Achieved

- Instant detection of location
- No need for intermediate organizations to inform you about person whom you are finding.
- Less man power required than manual system
- Running cost approx. 50 times less than the manual system, mean you hire a person for security purpose to track someone.
- Flexible enough to be extended in future.
- Minimum human intervention in getting the job done
- High accuracy of readings, since there is no human error involved
- As everyone uses smart phone so you can avail this opportunity easily.
- No need to get someone cell phone to talk to you or to remain in contact.

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GLOSSARY

- **API:** Application Programming Interface
- **SAPP:** Surveillance Application
- **CSS:** Cascading Style Sheets
- **FAQ:** Frequently Asked Questions
- **GSM:** Global System for Mobile Communications
- **GUI:** Graphical User Interface
- **GPS:** Global Positioning System
- **ISP:** Internet Service Provider
- **SMS:** Short Message Service
- **TBD:** To Be Decided