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## *Licence Management System Using Android - Requirement Elicitation and Detailed UML Design*

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*Abstract: Mobile based biometrics employing android technology combining the specialities of sophisticated tools and techniques with the cutting-edge business procedures and practices requires a very comprehensive collection of requirements combined with a detailed and thorough design encompassing different areas of knowledge. The idea of this paper is to develop a detailed design for managing driver, licence and vehicle information by the numerous traffic officials to replace the cumbersome existing system of licence verifications. It involves fingerprint processing on the driver's fingerprint image and OCR on the number plate vehicle using which the corresponding records are being retrieved from the database consisting of personal, licence, vehicles and offenses information. For detecting vehicle thefts, an SMS is being sent to the corresponding owner for verification to check for any malicious attempts of robbery in case of mismatch between the vehicle information and corresponding owner information stored in the database followed by data analytics upon the offenses information for deducing interesting patterns of the nebulous data records.*

*Keywords: Requirement; Design; Driver; UML; official*

### I. INTRODUCTION

Biometrics has been now for some time been the fore-front of every possible application domains ranging from Banking to Image Processing, Robotics, Security, Finance, Mobility and others. The extremely popular appeal to the people worldwide has made the researches in the corresponding field very vast. Even as we speak, more and more innovations are out in large numbers. Thus, to employ it to a real-time application as in licence management is the real objective. The field of licence checking and vehicle thefts [1] has many severe consequences both to the officials and the drivers due to non-systematic procedures and methodologies and the complexity and dynamism of the problem. This thus leads to an ingenious solution to be provided to this existing problem. A solution is thus proposed in this paper.

The system consists of the following flow of processes in the system as explained. It consists of the active entities driver, official. Suppose the driver is caught during driving on the roads and he does not possess the licence at that time. In the existing system, he is fined a hefty fine. But this system eliminates this by removing the concept of licence papers. The information of every registered driver is stored in a database server which is accessed by the official using the android device and the peripheral which he carries for verification purposes. The peripheral device captures the fingerprint of the driver which is used as the key measure for extracting the details of the respective driver which are personal and licence info. Additionally, the number plate of the vehicle is captured by the app which undergoes OCR transformation. It specifies the vehicle details which is used for matching the ownership of the vehicle that they are driving. If not complying with the results, in that case an SMS is sent to the respective owner of the recent proceedings and based on his reply, the appropriate actions are undertaken.

In addition to this, the system can be notified earlier of any other individual driver using the vehicle (perhaps family or friend) so that appropriate changes will be reflected for better performance and dynamism. Also, the cases of numerous

offenses are registered and they are mined at the database site for interesting patterns. All the diagrams are drawn using Visual Paradigm Professional Edition 12.0(Evaluation Copy) [2], [3].

## II. REQUIREMENT ELICITATION

### a) Textual Analysis

No.	Candidate Class	Extracted Text	Type	Description	Occurrence	High
1	Driver	driver's	Actor	The main beneficiary of this proposed system relative to the menacing existing system otherwise.	1	High
2	fingerprint processing	fingerprint processing	Requirement	fingerprint module of the system.	1	High
3	OCR	OCR	Requirement	OCR module impl. of the system.	1	High
4	business,technology	business,technology	Work Flow	Flow of control of the system.	1	High
5	SMS is sent	SMS is sent	Use Case	functionality of the system.	1	High
6	records are being fetched	records are being fetched	Use Case	functionality of the system.	1	High
7	data mining	data mining	Use Case	analytics of data.	1	High
8	requirements and design analysis document	requirements and design analysis document	Work Flow	the main purpose of the system.	1	High

Fig.1 Textual Analysis of the system

Textual Analysis involves the problem statement of the whole system and highlighting the important keywords in the statement. These keywords are either use case, workflow, actor, requirement and others. It is the first step for requirement gathering. It gives an insight and focussing specific words for branching further requirements from the problem statement as shown in Fig.1.

### b) Requirement Diagram

The requirement diagram consists of 6 different aspects namely hardware, Fingerprint processing, OCR, wireless access, data mining and performance(Non-functional) requirements. The attributes involved are ID, source of information, kind, method of verify, risk involved and status of progress. Firstly, hardware acquisition is done of both scanner and android device. Inspection tests are performed for functionality testing. Secondly, Wireless access is also a major requirement satisfying both accessibility and availability. Thirdly, fingerprint processing using MINDTCT and BOZORTH3[4] is achieved satisfied by cygwin emulator model. Fourthly, OCR processing is another major requirement involving a high risk and fully implemented module. Next, data mining via mining tools is also achieved. Lastly, performance requirements consisting of scalability, robustness and consistency is achieved using load, link and periodic test cases for mandatory optimal levels as shown in Fig.2.

The <<verify>> and <<satisfy>> are the links used with test cases and models respectively. Test cases verify the existence of certain properties in the requirement modules. Models help in satisfying the requirements using implemented or off-the-shelf products. The associations can be one-to-one(1, 1) or one-to-many(1, 1..\*). As far as the status of the modules are concerned, the fingerprint processing is implemented using bozorth3 and mindtct[4]. OCR processing is also implemented using matlab. Performance requirements for consistency, correctness, preciseness and lower response times are also achieved. Scalability is proposed. Hardware is acquired for these purposes. Also, the higher risk involving activities are prioritized and achieved accordingly. Cygwin achieves the fast processing of the fingerprints in finite amount of time. Also, data mining on the obtained data is mandatory. Different mining tools like Weka can achieve this purpose of obtaining the mining patterns.

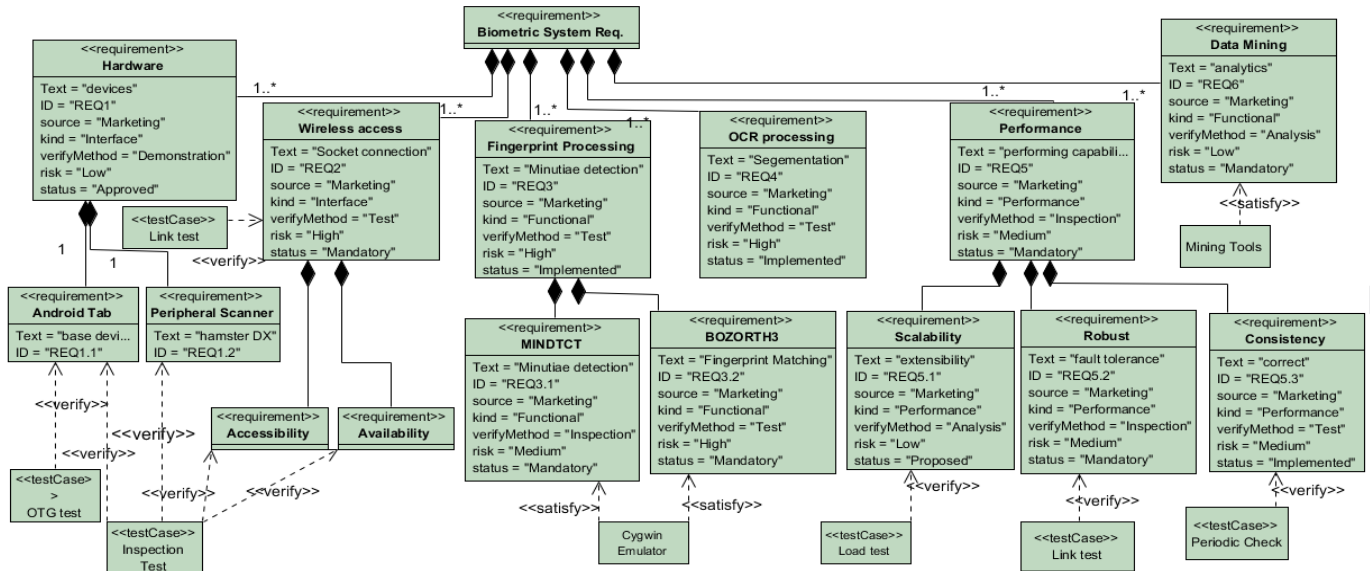


Fig.2 Requirement Diagram

c) Basic Diagram

This diagram classifies it further into more thorough requirement specification. It is classified into domain, business and technical requirements. They are motivation factor, vocabulary, specific functionality for domain; business factors, procedures, ROI(Return on Investment) for business; and hardware(Android device, scanner), Knowledge and tool support,software training and support for technical requirements as shown in Fig.3. They are maintained by the different experts like domain expert for domain knowledge, Business Analyst, Marketing, Sales for business requirements and System Analyst for technical, Data analyst for mining activities. The technical activities involves the different technologies like Eclipse, MySQL, MATLAB, Cygwin, Android, Mining Tools, etc. Appropriate training on these tools and softwares is also required for proper operation of the project and hence completion of the system.

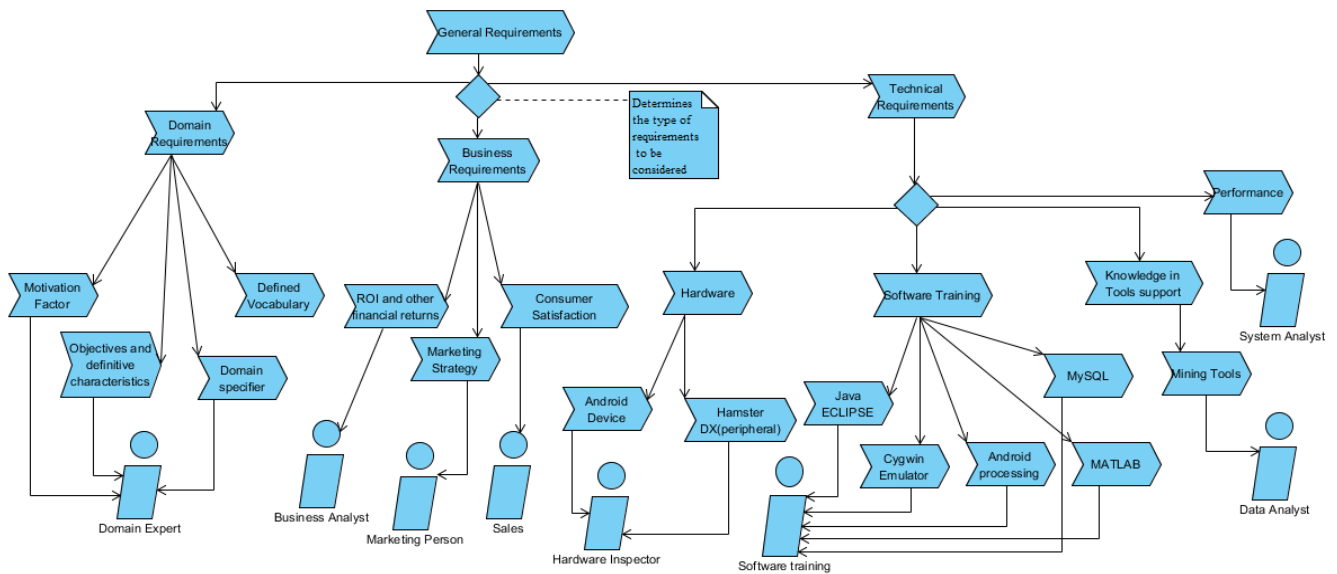


Fig.3 Basic Diagram

d) CRC Card Diagram

Here, the cards are arranged in an intelligent fashion so that the dependedent cards are closer while the non-dependent cards are far apart. The official interacts with the driver and hardware device who in turn interacts with the Main server interfacing with the analyst and database systems as shown in Fig.4. It aims for “Seperation of Concerns”. The diagram also specifies the

“Collaborator” which is list of cards dependent upon. They are specified in the list of responsibilities inside the card. Along with this, the list of attributes are unique to each of the cards mentioned. It specifies the inter-communication, inter-connection and aims to reduce “coupling” for a better structural document at the preliminary stage.

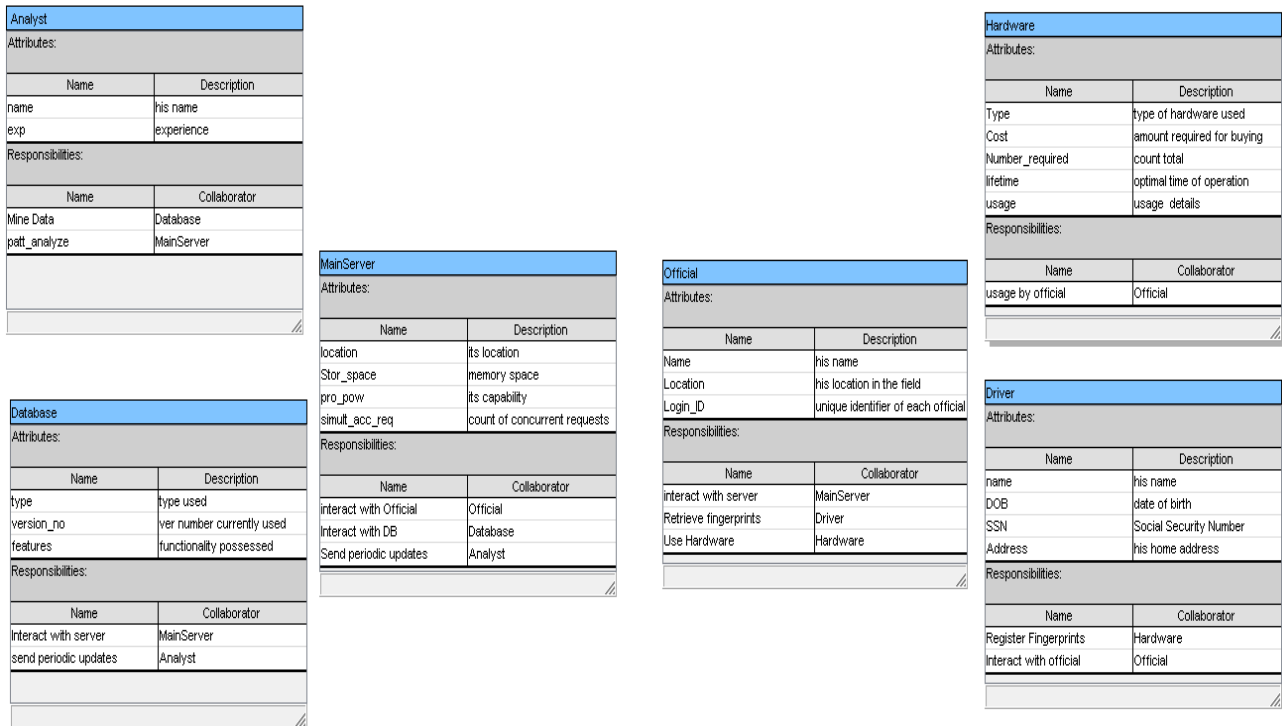


Fig.4 CRC Card Diagram

III. UML DESIGN MODELS

a) Class Diagram

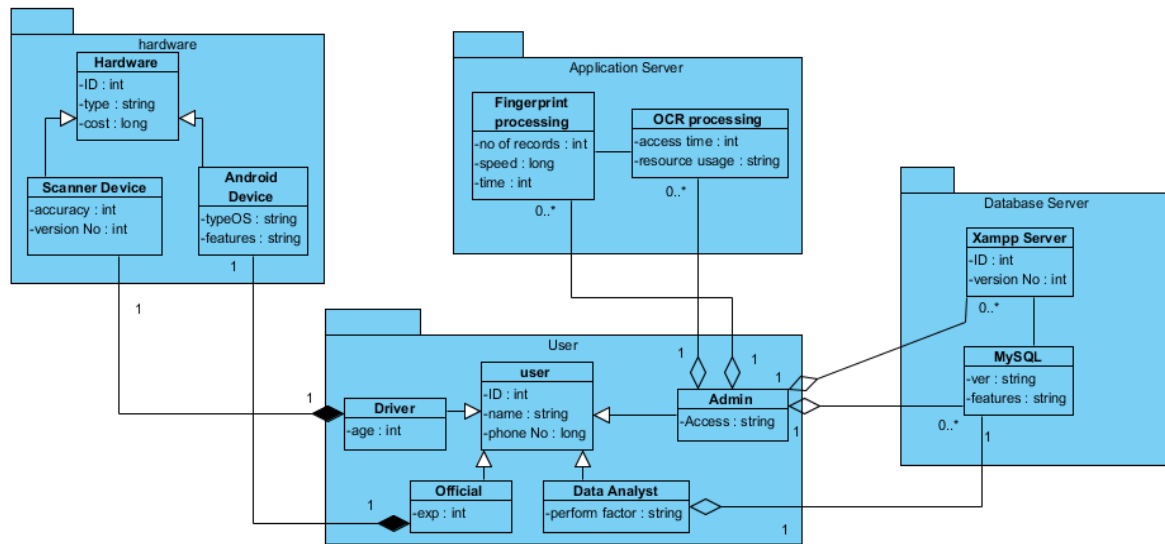


Fig. 5 Class Diagram

The class diagram consists of the various hardware components constituted by the Scanner and the Android device. It is accessed by the User which can be driver, official, admin and data analyst. It also consists of the Application Server of fingerprint and OCR processing accessing the database server of MySQL database connection.

b) Use Case Diagram

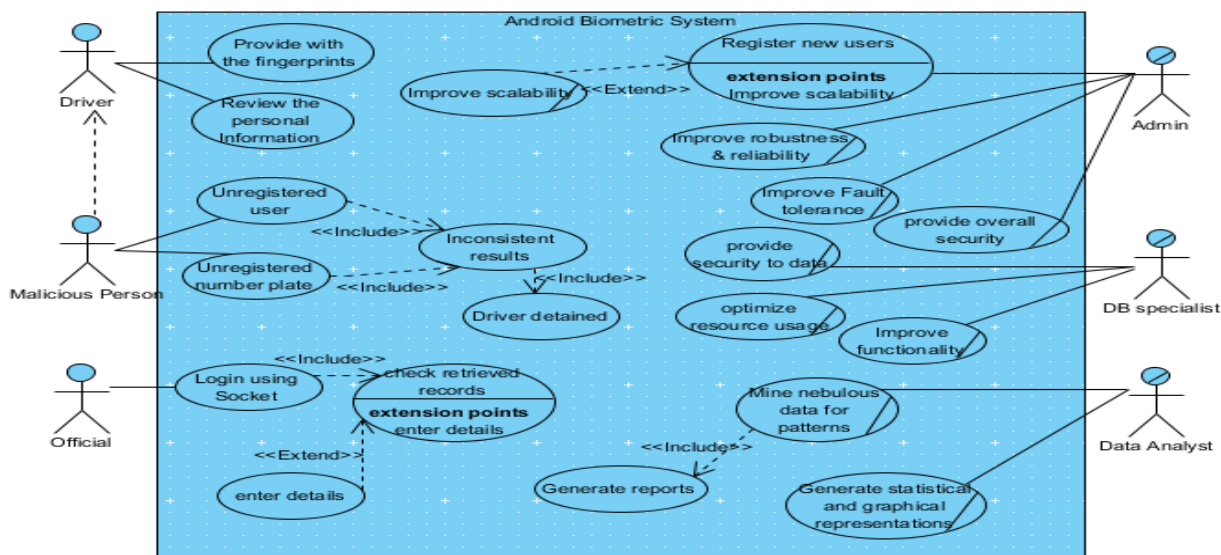


Fig.6 Use case Diagram

It provides of how a view would look like from outside the system to the users as a whole. The most important diagram in the entire modeling concepts which is viewed by the customers, stakeholders, vendors, users and other important investors. The actors involved are Driver, Admin, DB specialist and data analyst. Out of these, ones on the right are “Business Actors”. There are use cases which provide interaction with the system. Similar to actors, there are “Business use-cases” for providing business activities. The associations are <<include>> for including other dependent use cases and <<extend>> for extending other independent use cases.

c) State Chart Diagram

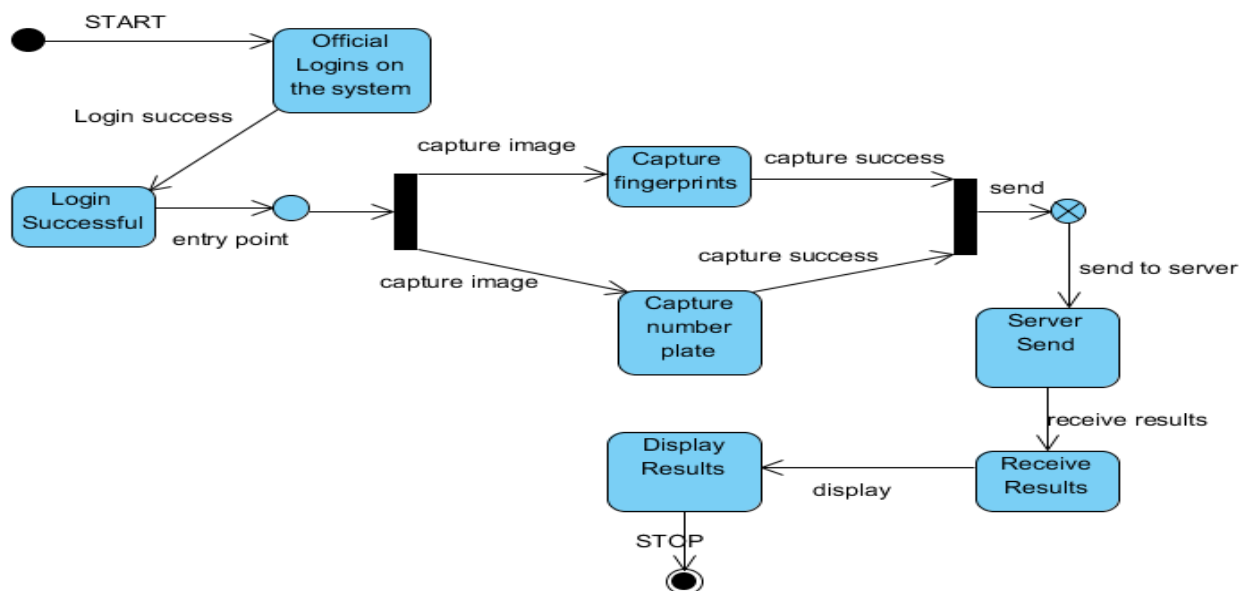


Fig.7 State Chart Diagram

It starts with the successful login with the capturing of the number plate and fingerprint of the driver along with sending the same to the server and receiving and displaying the results retrieved. The state diagram consists of “fork” for splitting incoming transitions into multiple transitions ending on orthogonal target vertices and “Join” for merging several transitions emanating from source nodes. Fork is used as entry point for multiple transitions into fingerprint and number-plate recognitions. Entry and exit points are used to depict composite states.

d) Sequence Diagram

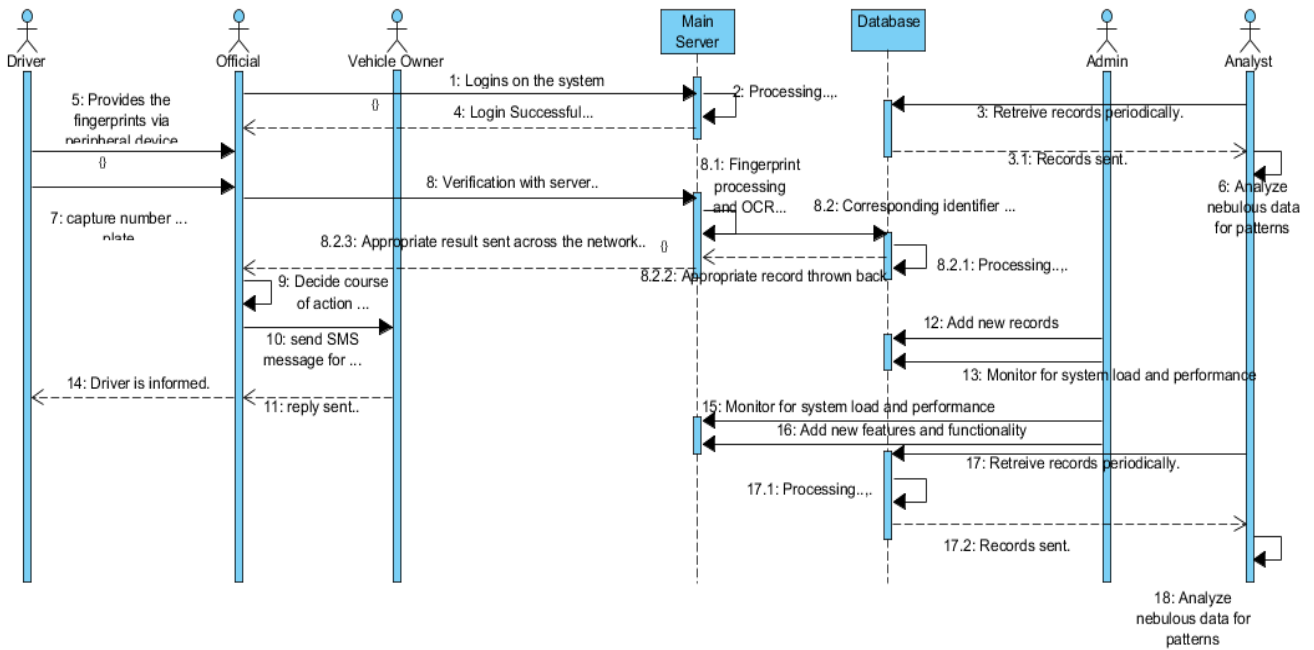


Fig.8 Sequence Diagram

The sequence diagram consists of the driver, official, vehicle owner along with the main server, database, admin and analyst. The official logs on the system getting verification message with the driver providing with the fingerprints. It proceeds with the processing and sending the results back to the official. Meanwhile, Admin monitors the system to improve the system along with analyst continuously mining the data for patterns and capturing with archival and purging the obsolete data.

e) Communication Diagram

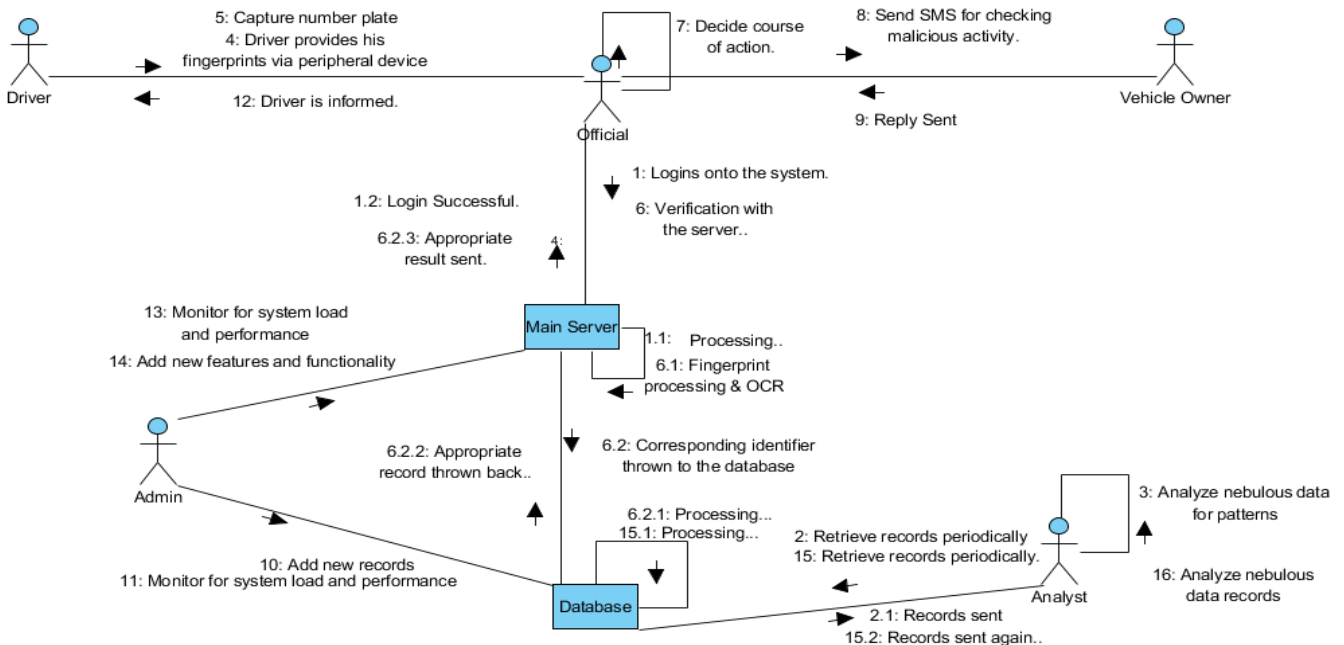


Fig.9 Communication Diagram

The arrow-heads point to the direction of the data flow in the system with the inclusion of self-loops indicating the presence of some processing in the entity. The Main Server is at the epic of all the processing center hence the communication and overhead involved is relatively high compared to the other entities. The upper part mainly relates on the front-end part while the lower part relates upon the back-end side regarding all the processing and fast transmission of data elements.

f) Activity Diagram

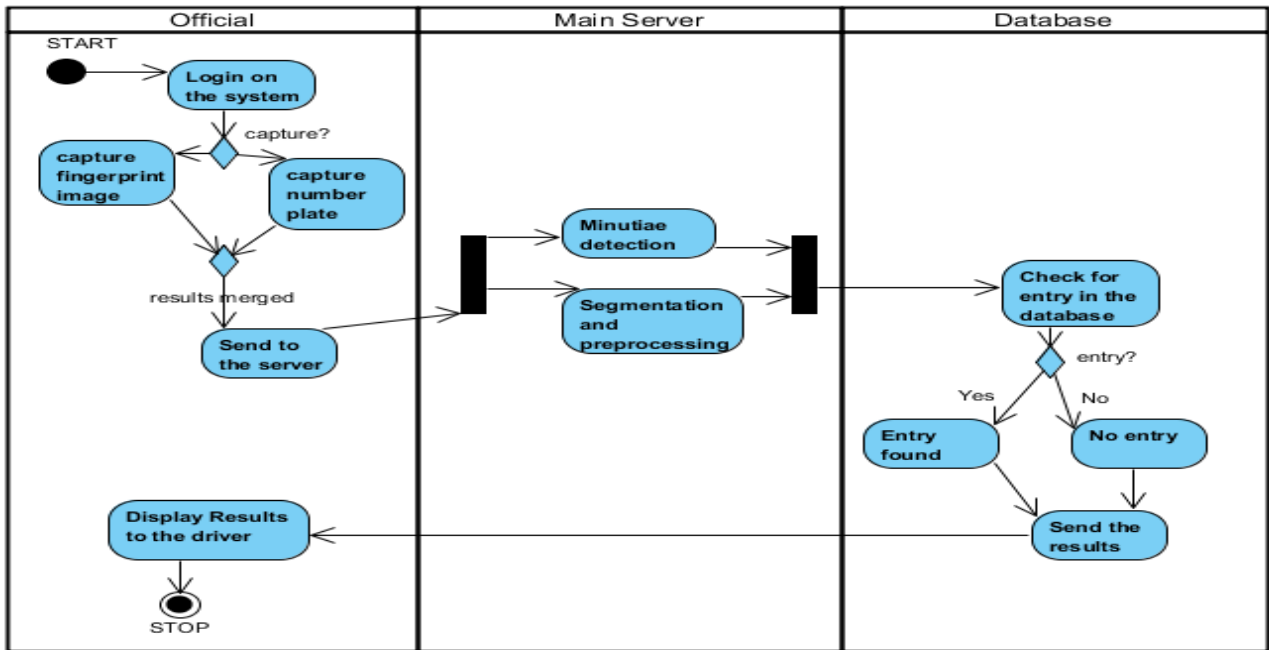


Fig.10 Activity Diagram

The activity diagram consists of the flow control and the assignment of the responsibilities of every particular entity to their respective roles in the system. It is also called as “Swimlane Diagram” representing the swimlanes along the pool. It consists of the login on the system using socket connection along with the forking into two child processes and merging them again before they are sent to the server. These are again used for the respective operations at the Main Server and based on the identifier thrown by the system, it is used for a “lookup” for the corresponding entry at the MySQL database.

g) Component Diagram

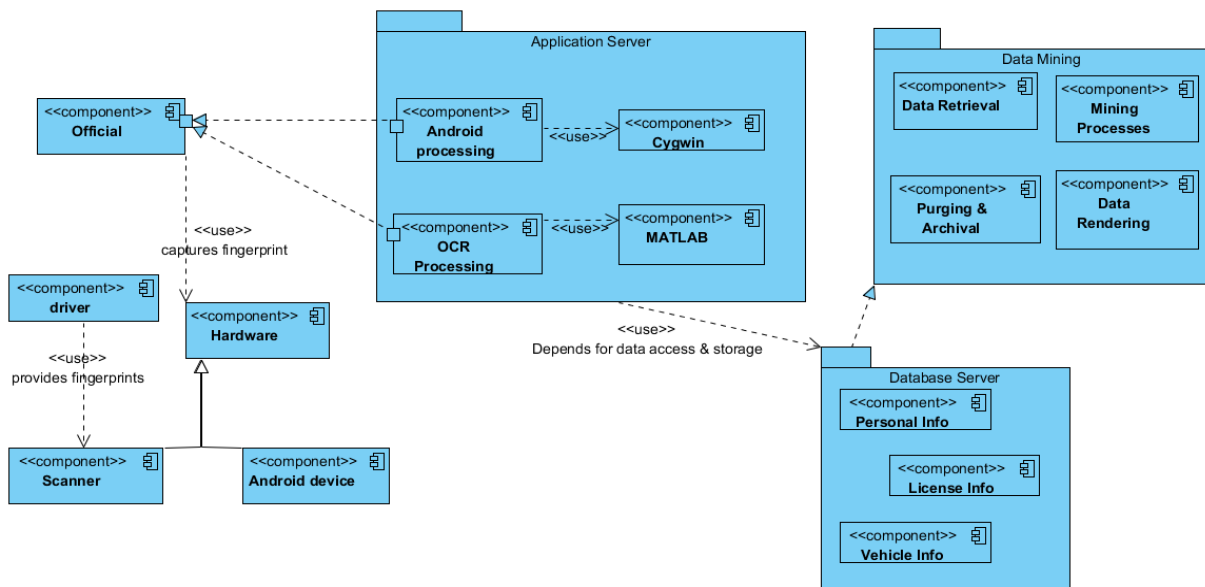


Fig.11 Component Diagram

It depicts the interaction among the various modules which have their own independent functionality for execution. The components use the other dependent components for their complete or partial implementation. To increase cohesiveness, the various components used including Application Server, Data Mining and Database Server are encompassed in a single package and accessed using linkages.

## h) Deployment Diagram

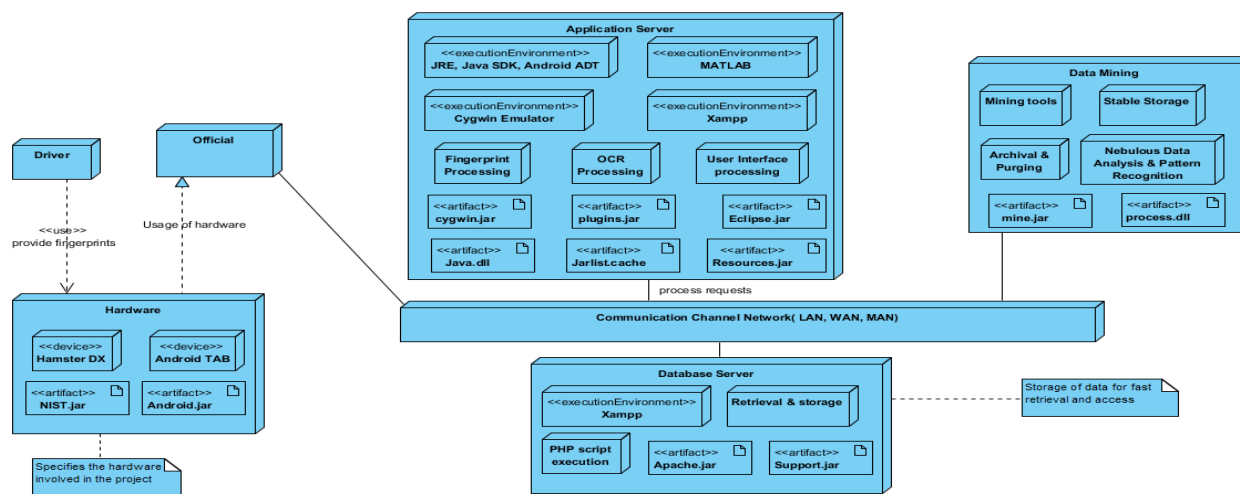


Fig.12 Deployment Diagram

It consists of various execution environment nodes for providing a platform for proper implementation. It also consists of the artifacts (.jar, .cache, .dll) for fast linking with the nodes, device nodes for interaction interconnected by a high-speed network.

## IV. CONCLUSION

Thus, the development of detailed design involving a thorough requirements list has simplified the process of obtaining a better understanding of the system. The proposed system will be a great deal in helping the traffic control for the officials. The design wishes to achieve that objective to make it a reality. Detailed flow along with the interactivity of each tools and techniques in the development context is also explained in detail. This system can be expanded further by improving the processing power and adapting it for distributed network systems.

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