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SMART DRIVING COMPETENCY ASSESSMENT APP USING ANDROID PHONE

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ABSTRACT

Beginner drivers are at greatest crash risk. Drivers training is one of the interventions aimed at mitigating the number of crashes that involve young drivers. The failure to understand what is really important for learners, in terms of higher level competent driving, is one of the many reasons constraining the building of better training programs. It is not possible for trainers and driving mentors to simultaneously assess drivers' actions accurately, cognitive skill and vehicle control, relative to environmental circumstances. Driver's driving abilities also play a vital role in judging the road environment and reacting in time to avoid any possible collision. This research is to design and develop a mobile application and a web portal that would assist technicians and drivers assessor in decision making through access of relevant information in relation to Road Transport Authority criteria for drivers' performance assessment and admission requirements. In addition to that, a web portal is also incorporated into the system to ease information access and decision making from administrator. Moreover, it aims to collate and avail such information on a platform accessible to the assessor, as well as other authorized parties, via mobile phones and web platforms. The service can parse out the incoming data, validate the data, and store that data in a database for retrieval and reporting purposes. The interaction between the driver's examiner or assessor smart phone and the web service will be implemented via Wi-Fi or 3G/GSM networks. The network connection is automatically

selected depending on the availability of such technology, which is directly related with the examiner's location.

KEYWORDS: *Android Studio, Mobile Office System, Driver Performance, GSM and Shimmer Sensors.*

INTRODUCTION

Today, people follow the news, check train timetables and the weather, chat with friends and plan their routes even as on the move. People tend to use their Smartphone's many times during the day to obtain short news updates, to send massages and to check social media sites.[1] Smartphone's allow social examination data to be collected in a relatively quick and easy way. Vehicles have greatly improved the transportation of commodities and communities around the globe. Crashes have been the most outstanding danger associated with vehicles and often result in serious injuries or loss of human life. Training does improve the driving performance required for road and public safety. The training program resulted in important road and public safety messages being relayed and adopted in a relatively short time period. The field of road safety should consider the potential benefits of training. One of the key aspects of driver training programs has been assessment or feedback on the driving tasks.[2] The research findings clearly support the contention that the driver training program effects positive changes in driving attitudes and behaviors'. To provide an effective feedback to the drivers, it is necessary that the massive amount of data related to the driving tasks is presented in an efficient and user friendly manner. The current data processing and reporting of driving competence assessment result from the drivers and technicians training and competency assurance center to the regional or federal transport authority; the reports that will be generated will be much delayed and error prone. Manual entry consumes more time. It is difficult to maintain bulk of record in manual. Not easy to prepare the daily reports. Lack of accuracy and error prone; overall efficiency is less, lot of paperwork, non-secure; no perfect maintenance of report, no method to trace detail, human errors, searching is more time consuming. This intern would make the decision making process of the road transport authority late from taking action issuing driving license for the candidates each day and each year.

LITERATURE

Driver assessment from a human perspective is multitask, observing complex behavior that includes task such as steering, managing the throttle and brakes, controlling the speed, lane

choice, navigating and hazard detection. Monitoring all these abilities requires excessive and complex processing on behalf of driver trainer. Smartphone's in vehicles are being widely utilized for the aggregation and exploitation of traffic information. Providing drivers and other transport user's information with respect to the quality their route is another useful application for Smartphone-based sensing and specific relevance for collaborative driving systems.[3] The automated detection of lane departure warning system, aggressive driving, driving style characterization, drunk driving detection, eco-driving assistant, dangerous concerning, scoring and feedback, fuzzy logic driving risk level scoring have been attempted by multiple mobile machine to machine systems.[4-5] Guru,[6,7] by identifying traffic signal light colors through Smartphone-based cameras. Smartphone-based vehicle information monitoring is mainly used for vehicle diagnostics and other vehicle health related applications. Systems proposed by Zaldivar et al.[8] and Yang et al.[9] respectively, interface with a vehicle's electronic control unit (ECU) to retrieve and process information relevant to the vehicle operator and provide a user friendly interface. Providing drivers and other transport user's information with respect to the quality their transport route is another useful application for Smartphone-based sensing and is of specific relevance for collaborative driving systems. Eriksson et al.[10] Mednis et al.[11] and Ghose et al.[12] have developed systems that detect road condition indicators such as potholes, bumps, rough- and uneven roads, using GPS and accelerometers. Fazeen et al.[13] experimented with road condition characterization and mapping to a Google Earth map. The Nericell application developed by Trivedi et al.[14] is also designed to identify driving conditions such as potholes, bumps and honking at chaotic intersections. In 2010 Dai et al.[15] developed a drunken driving detection system that aims at detecting drunken driving manoeuvres using only a Smartphone-based accelerometer. In the following year Johnson and Trivedi.[16] developed a Smartphone-based driver behavior monitoring system that attempts to classify several aggressive and non-aggressive driving manoeuvres using only Smartphone-based sensors (MEMS-sensors and GPS). Drive Gain.[17] is an example of an application that attempts to improve driver fuel economy by advising the driver of bad driving habits according to the detected driving style. Vehicle insurance telemetric aids insurance companies in quantifying the actuarial risk associated with a driver. Händel et al.[18] provides a detailed investigation into the necessary characteristics of a Smartphone-based insurance telemetric system.

METHODOLOGY AND DESIGN

An assumptions taken and then design descriptions, and also how to implement it and

platform examination on this application is fully functioned. Hence, solution design approach in this case can be generally grouped into the performance criteria (response time and throughput), dependability criteria (modifiability and portability), maintenance criteria (robustness, reliability and security) and end user criteria (utility, usability and availability).

A. Architecture of the system

Centralized client-server architecture has been chosen for this system. However, the use of web services makes it hybrid. The system has few users hence there was no need to have it distributed. Only the Director of Drivers Competence department has access to it plus a web interface that allows Transport Authority to give updates on the driving competence assessment identified by the driver trainer. Nevertheless, this architecture is determined by portability, data sharing and distributed processing. An attempt to maintain the accuracy and integrity of the data (assessments) collected from the exercise area and sent to a central server over a 3G network. The 3G wireless network is the mobile broadband internet connection of choice. Data collection is done on a native mobile application. The central server offers storage and processing functions. The server also offers an interface for sharing data with other related systems. Data received from the mobile application is processed by PHP scripts and stored on MySQL database. An apache HTTP web server application provides an interface for smart phones to connect to the central server. Now the assessor or director of drivers and technicians competency can view scores and also visualize competent and not yet as a graph (line chart). The scores, now stored on the central server are also accessible to administrator for monitoring and evaluation purpose.

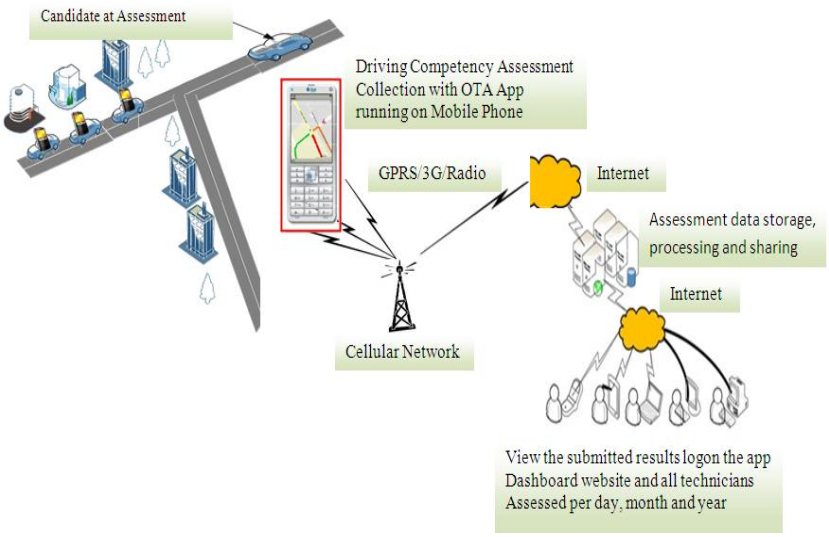


Figure 1: System architecture.

B. Algorithm of Smart Driving Assessment Mechanism

In order to develop the smart driving assessment system the algorithm has been developed and presented below. The algorithm followed what the OTA app aimed accurately tell the amount of skills of the driver.

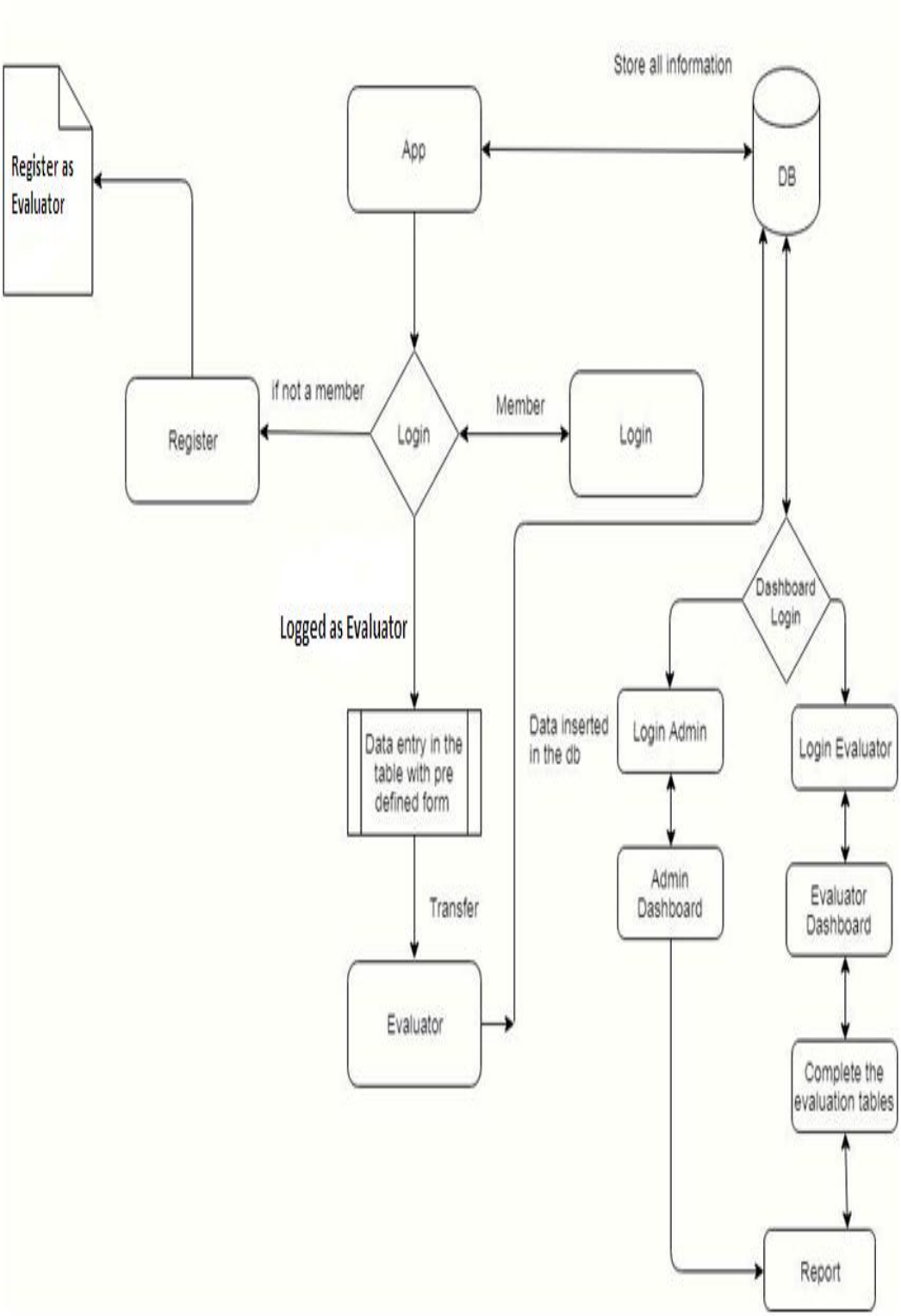


Figure 2: Site flow for Android Mobile App and Web service.

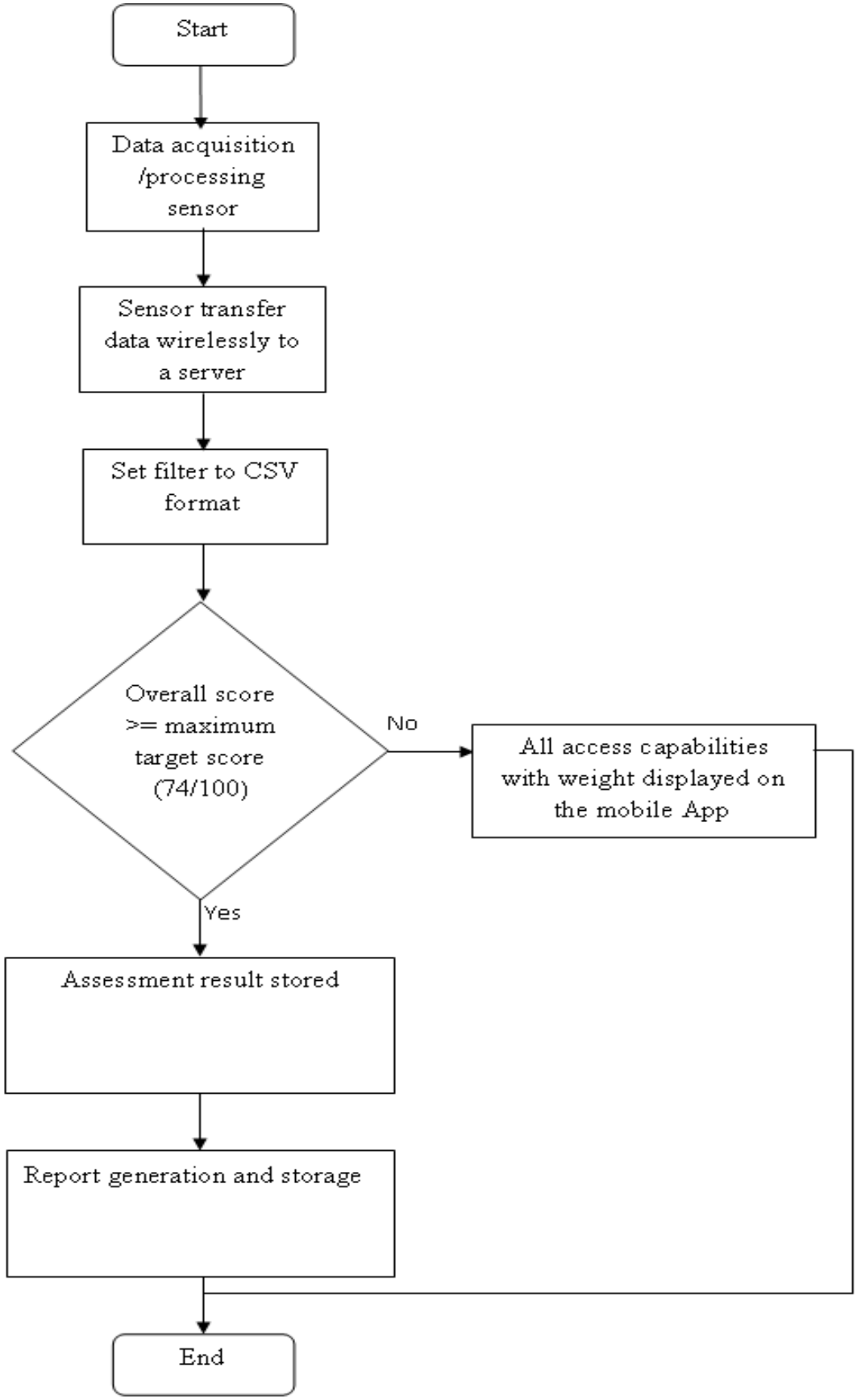
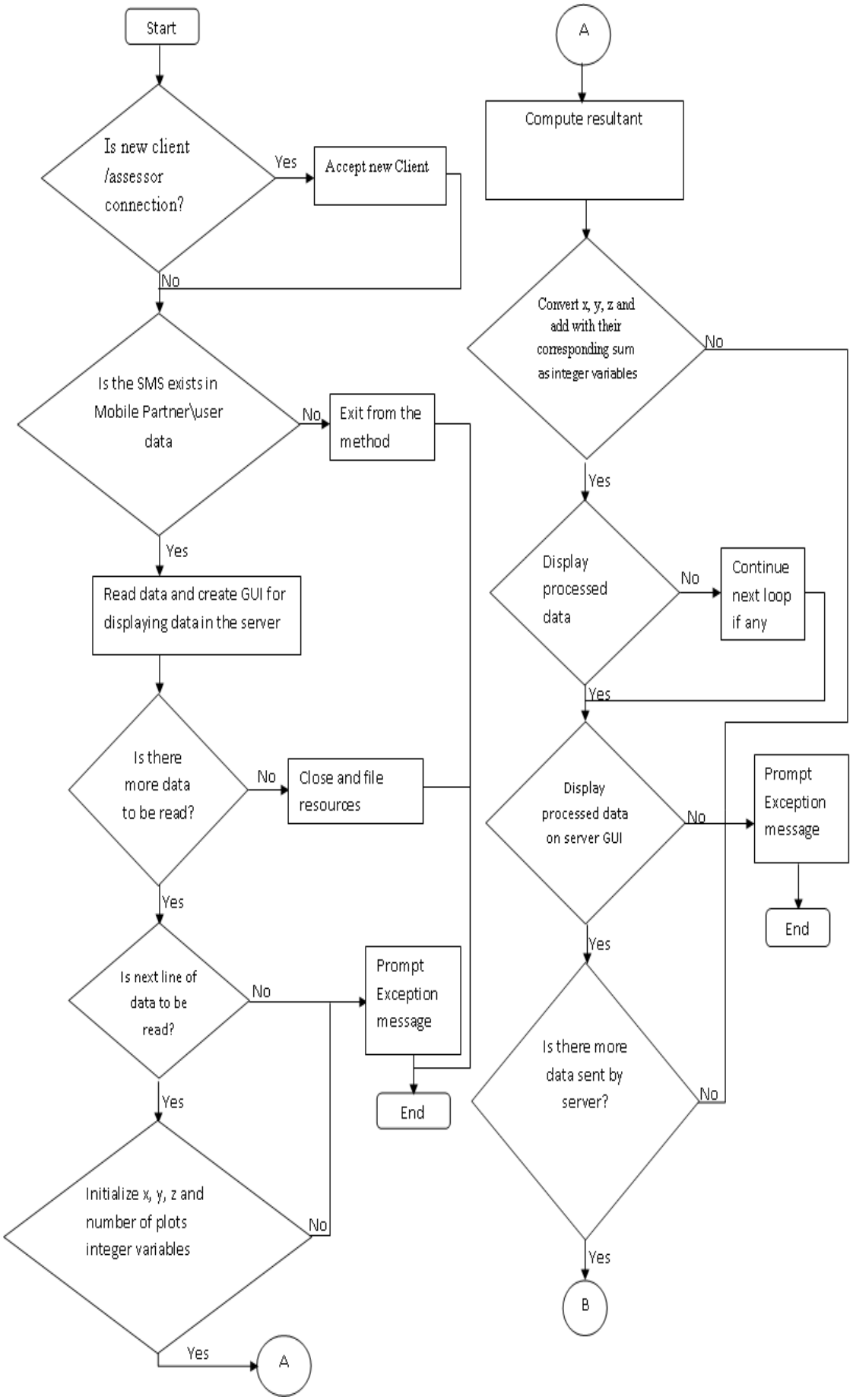


Figure 3: A general algorithm for developing smart driving assessment system.


Start
Is new client /assessor connection?
Yes
Accept new Client
No
Is the SMS exists in Mobile Partner\user data
No
Exit from the method
Yes
Read data and create GUI for displaying data in the server
Is there more data to be read?
No
Close and file resources
Yes
Is next line of data to be read?
No
Prompt Exception message
End
Yes
Initialize x, y, z and number of plots integer variables
No
Yes
A
A
Compute resultant
Convert x, y, z and add with their corresponding sum as integer variables
No
Yes
Display processed data
No
Continue next loop if any
Yes
Display processed data on server GUI
No
Prompt Exception message
End
Yes
Is there more data sent by server?
No
Yes
B

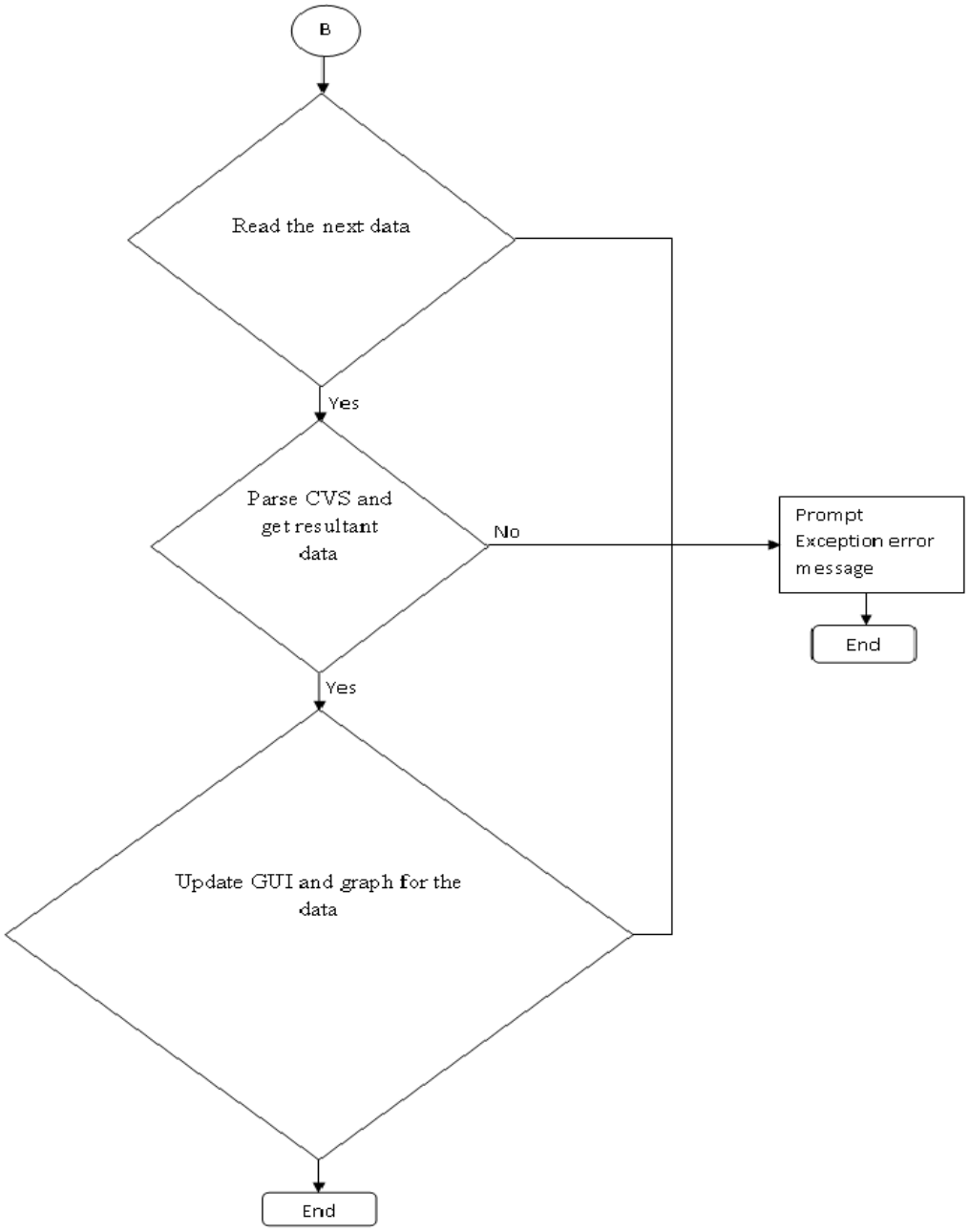


Figure 4: Algorithm for Driver's Permit Road Exercise Assessment.

C. Assessment Mechanism

As mentioned, the system that as the ability to identify and access driving competency and has potential to provide feedback on the strength and weakness of a driver is needed. The identified competency assessment consist two parts, the handling exercise and road exercise. The selected access capabilities were under supervision of drivers' assessor and the drivers driving competency assessment system. The system able to segment out the selected access capabilities and the associated variables recorded during the performed driving competency. The system helped to objectively identify the driving competency. The assessments were rule

based assessment. In order to present these assessments and feedback to trainees and their assessor, an interactive user interface highlighting the strength and weakness of the drivers and technicians was designed. The validation of the assessment was made by comparing to the subjective assessments of the driver assessor for particular access capabilities. Benefit of the system framework includes identifying and sharpening driving abilities those are required for skilled driving.

Implementation

Implementation was divided into OTA-app-mobile application and centralized view-web application. Different tools will be used for different purposes in the analysis, design and implementation of the system. Among these toolsl; XML for frame design and Android SDK through Eclipse IDE for developing front end, Java, WAMP synchronisation (Apache server, MySQL, PHP) for back end and MySQL for developing the backend database, a computer system with specification higher or equal to the minimum specitfication mentioned to XAMP OR WAMP and android studio and mobile phone for debugging while development . After development, the application is compiled and tested using Software Development Kit (SDK) emulator on windows and a HUAWEI Smartphone device. The web system receives interfaces with the mobile client to receive requests from end users, and it also provides front-end for presenting assessment result data to administrators. Driving competency assessment data was stored in MySQL database.

RESULTS AND DISCUSSION

The android mobile application runs on a tablet and its main purpose is to enable users, the assessor or trainer officers, to collect driving competency assessment data and then send it to the server. The Smartphone running the application requires an internet connection. In a nutshell, the mobile application is aimed collecting assessment, recording driving competency assessment details. The web application retrieves and presents assessment information that is sent by the mobile client to the database. It resides on the HTTP web server and is linked to the database. In addition, user accounts are managed using the web interface. Using the web interface, driving competency assessment result can be linked to specific candidates profile and reports can be generated.

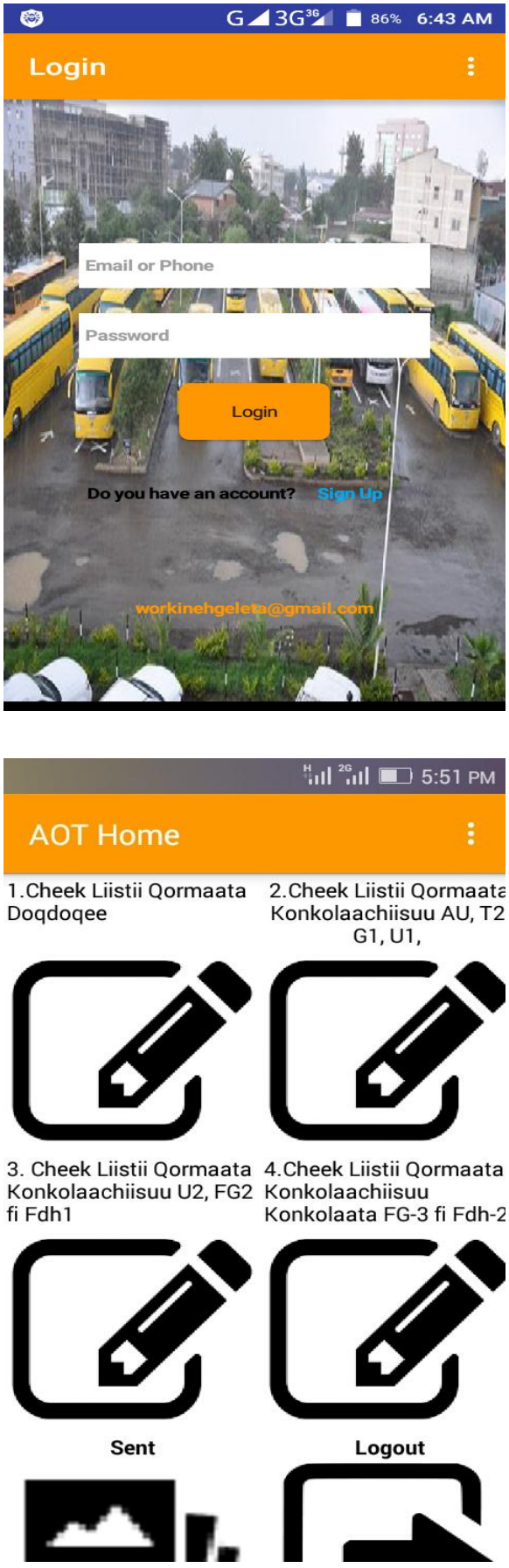


Figure 5: Login and Option dashboard screens.

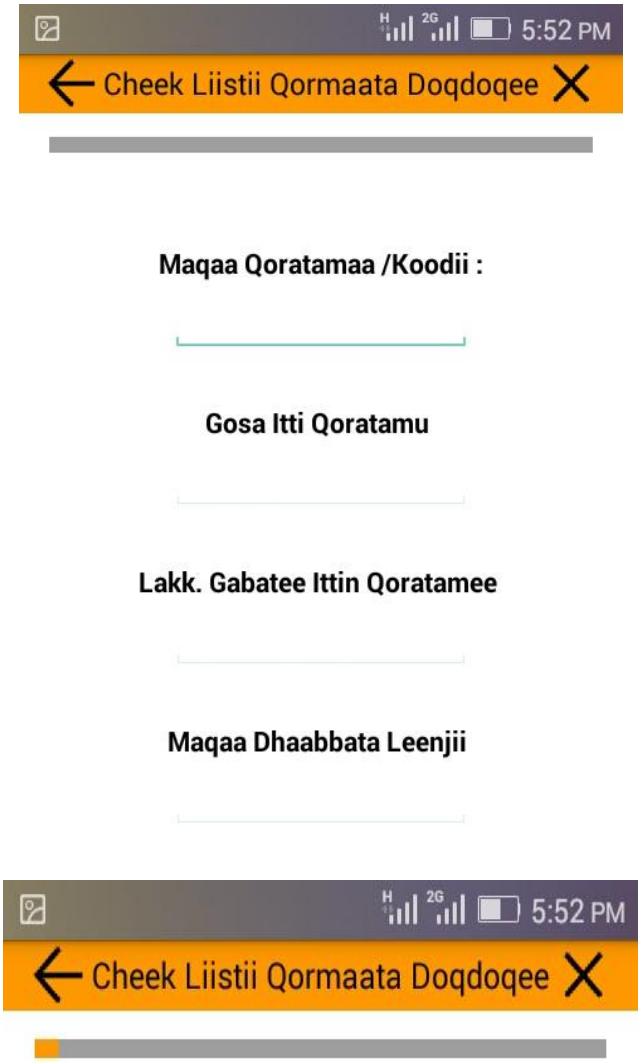


Figure 6: Vehicle and Drivers details.

Figure 7: Assessed capabilities details.

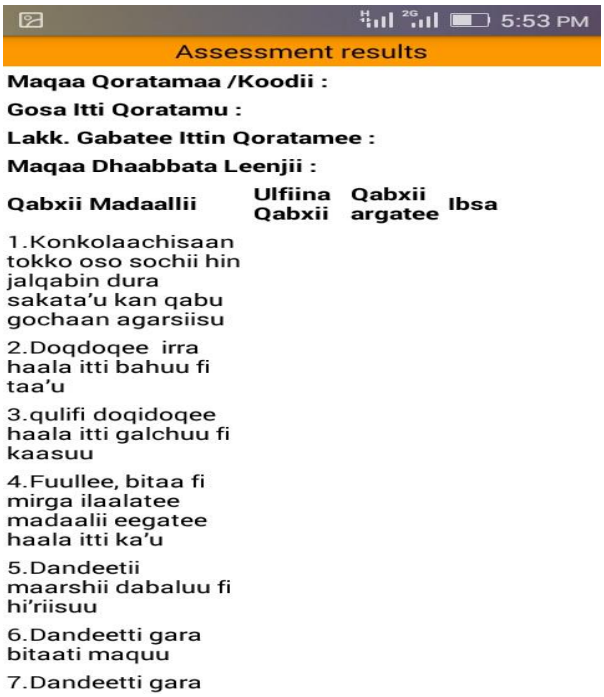


Figure 8: Drivers permit road and handling exercise assessment checklist screenshots.

The main role of the web component is to allow access to the collected candidates driving competence assessment data. With it, the following can be done:

1. Search candidate's assessment result by date, name and Vehicle plate number, to show the details on with info window as shown in Figure 10.

2. Add follow up assessment and recommendation to selected candidate.
3. Generate tabular and graphical reports from the stored data.
4. Give updates on the progress and condition of the driving competency assessment result causalities.

The kinds of reports that are generated by OTA application include the following;

a. Graphical representation of assessed driver per day, month and year Distribution.
b. Graphical Distribution of competent and not yet competent candidates.
c. Tabular Distribution of candidates driving competence assessment result.

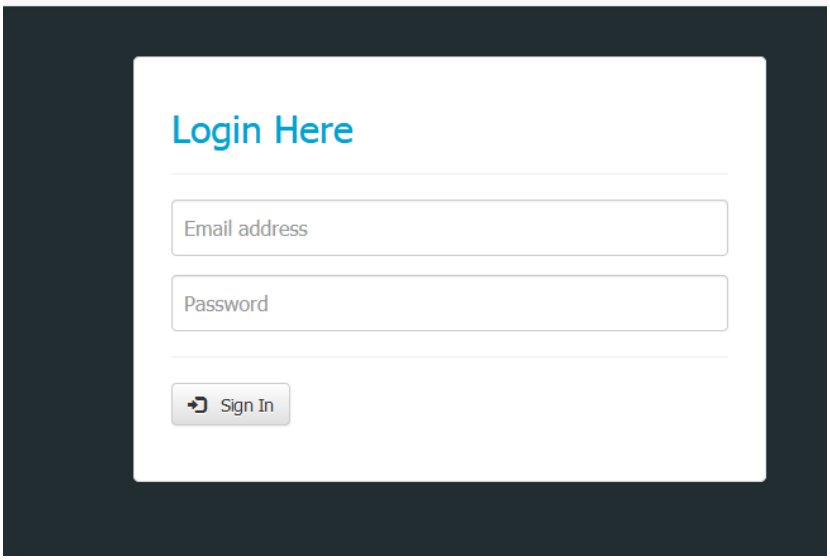


Figure 9: Web service login screenshots.

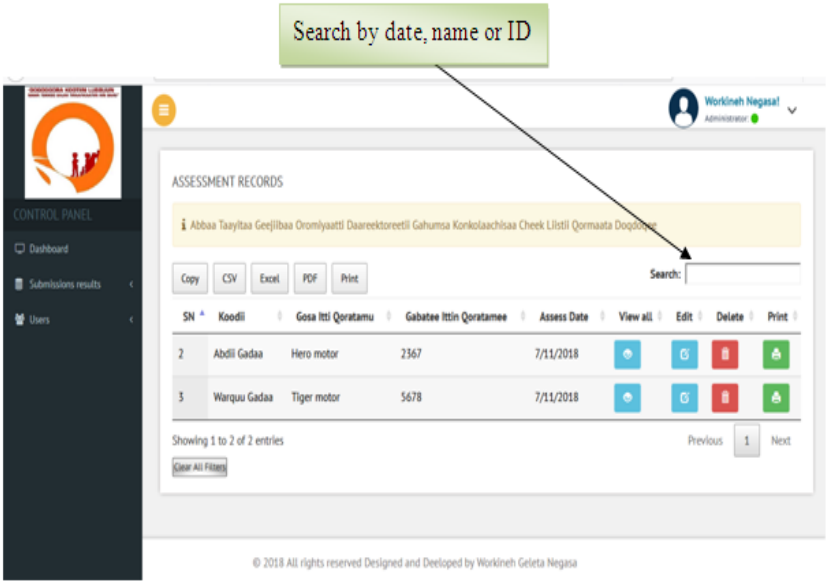


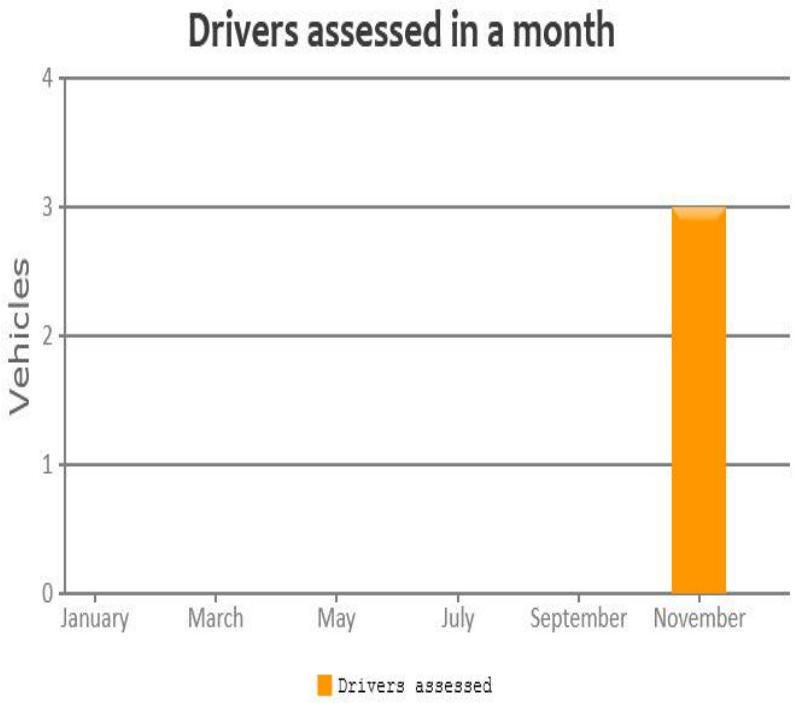
Figure 10: Assessment records and search.

Oromia Transport Authority

Director of Drivers Competence Report

Assessment Criteria		Weight	Score
1	Candidate involved in an activity resulting in automatic disqualification		
2	Candidate failed to complete the circuit within five minutes		
3	Vehicle touched a marker		
4	Vehicle crossed the imaginary line between the markers		
5	Engine stopped more than twice		
6	A third party assisted the candidate		
7	Part of vehicle outside the parking space		
8	Vehicle positioned non-parallel to the side markers		
9	Candidate exited the vehicle to check the position		

Figure 11: Generate tabular reports from the stored assessment result.



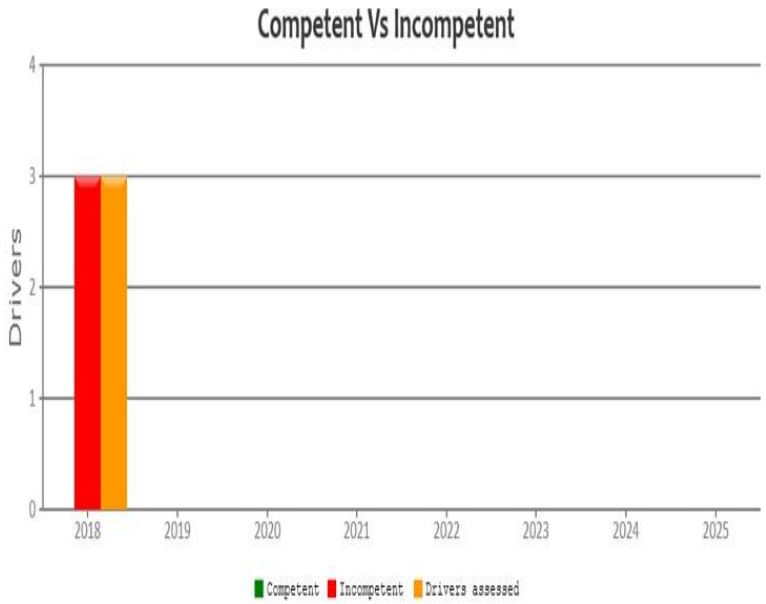


Figure 12: Graphical Distribution of competent, not yet competent and assessed candidates.

Performance Assessment Analysis

The driver's assessment system that was designed will help the driver's assessor in judging a series of moves requiring skill and care. This system contained the core components which were the data registration, physical movement identification and the assessment. These components work together to synchronize, analyze and assess the safety of driving competency assessment (handling exercise and the road exercise). The results from the driving experiment indicated that significant difference existed between fresh and experienced drivers in terms their road exercise assessment criteria while performing. Interestingly there is significant difference were found for the indicating before turn. This suggests that young or fresh drivers who participated in the study had not same judgment of distance calculations as experienced drivers. These results help to identify competency assessment that can differentiate low/high level of driving competency for the assessment criteria. The competency assessment system designed helped identify driving abilities that are required for skilled driving. These automated assessments will act as an assisting tool for the driver's trainers and trainees to identify the driving competencies required and understand shortcoming on part of young or fresh drivers and technicians.

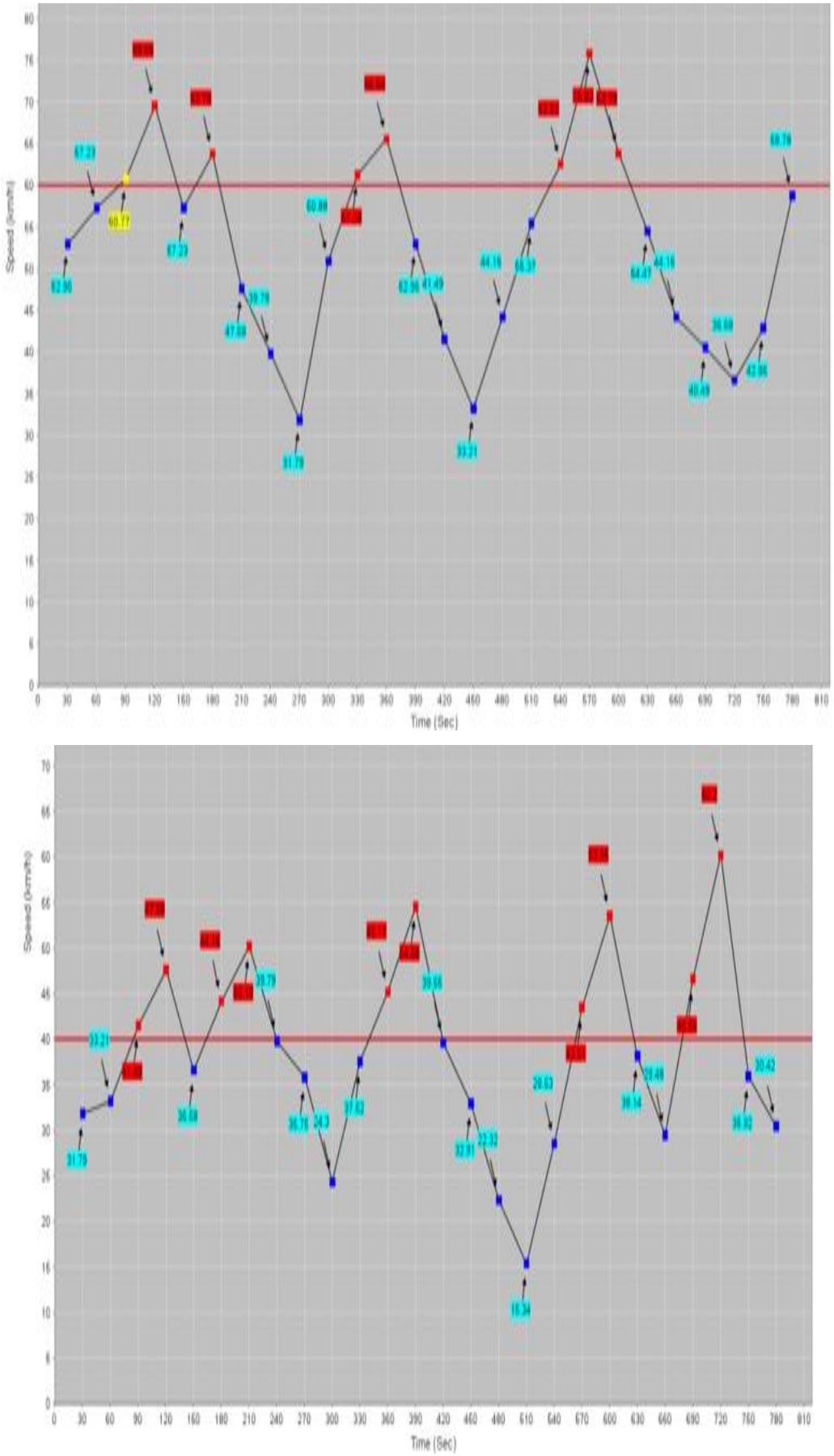


Figure 13: Analysis of performance of the Driver

Testing

Before the experiments and results, let us think of how-to the measure the functional and non-functional requirements and how successful results were measured. A use case was used to present functional requirements of the system. Here the platform is fully checked whether the complete system had the features that were promised in the use case. The test cases were simulations on real-life scenario. The outputs from the tests were then compared with what was expected. There were two non-functional requirements that were tested i.e. user interface and usability. A questionnaire was used to measure usability satisfaction from the users. The test questionnaire was presented to the users after they had used the application. Acceptance tests were done on the final system to find out whether the system met functional requirements. One real life case was used to determine whether the mobile application and the web system delivered its promised functionality.

CONCLUSIONS

There has been successfully designed and developed a mobile application and web service that offers great benefits in driving competency assessment assurance data collection. An automated mobile solution for driving competence assessment reporting system can provide a number of benefits over the current reporting system used by Drivers and Technicians Training and Competency Assurance Center. These benefits are lower costs of processing and report communication, centralized data which is easy to secure, backup and share, updates can be made easily. Almost always up to date, than a year long update, increased availability at any time any where, automatic generation of different reports with different formats and reduction of erroneous report generation. However, the solution presented in this paper can only be successful if it is backed up by the government.

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