A CROWD-SOURCING BASED EXPRESS BUS ASSESSMENT MOBILE APPLICATION

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ABSTRACT

Express bus is one of the important public transports in Malaysia. Frequent express bus accident is a nightmare to government and communities of Malaysia. In this paper, we proposed a mobile application that takes bus passengers perception on their journey experience to monitor the quality of express bus. In addition, the mobile apps will trigger emergency message and location to stakeholders. The development methodology of the mobile application is following ADDIE (Analysis, Design, Development, Implementation and Evaluation) model. The mobile application was develop using Ionic 3. The bus assessment framework based on the passenger input could reduce the fraud report that totally generated by the bus company itself. In addition, the bus company can monitor their driver with the help of the crowdsourcing method that based on the input from the passenger.

Keywords: Mobile application; passenger perception; ADDIE, bus accidents; bus assessment.

INTRODUCTION

World Health Organization (WHO) estimates the governments in the whole world losses USD 518 billion only for accidents (Jwan, 2017). Most of these accidents are caused by unethical driving habits and disregarding traffic laws and regulations. This phenomenon is worrying and needs to be addressed by improving aspects including driver management, vehicle management, travel management, road safety education among public and private vehicle drivers. Increasing road safety knowledge is one approach to reduce road accidence. The road safety learning and awareness has been publicly exposed to Malaysians since childhood via the road safety module introduced by the government in schools. A dynamic measurement tool is indispensable for measuring the weakness of the existing module so that it can be streamlined from time to time.

Another approach that can be used is by utilizing the smartphones technology. Astarita et al. (2014) apply smartphone technology to do road safety assessment. The application is focusing on improving safety level on road networks. The GPS-enabled client smartphones capable to acquire individuals vehicle's kinematics to be shared on a web server for road operators and user analysis. The cooperative system allows road operators to analyze and highlight critical points on the road network. The application is call SafeCityDrive. The application is capable of capturing user's behavior in each trip and tries to educate drivers on better driving style. Freidlin et al. (2018) also use iPhone and Android smartphone to detect driving maneuvers such as braking, cornering, turning at different acceleration levels (i.e, mild, moderate or hard). MIT also proposed a mobile-based telematics apps; DriveWell in 2010 that measuring driving behaviours(Harris, 2017; Cambridge Mobile Telematics, 2019; MIT, 2016). The technology is focusing on user to improve their driving habits, while insurance companies use to offer rewards and discounts to safe drivers. Some of insurance company take data from the DriveWell apps. The mobile application is an inspiring example of how mobile applications help to reduce bad driving habits (Sarath, 2019). In contrast, Khelifi et al. (2013) proposed MASAR (Mobile Application for the SAfety on Roads). This application enable driver to access to traffic information, mainly road works and incidents, to help them to plan better journey in Abu Dhabi.

Passenger perceptions are very important element in rating quality. There are several researchers that utilize passenger perceptions for evaluation. Minhans et al. (2015) has analysed user perception to assess bus service quality, i.e; reliability, transit service and facilities, bus fare, bus characteristics, conduct, information, and suitability. While Imre & Celebi (2017) measuring perception of comfort for public transport in Istanbul. Weng et al. (2018) has evaluated bus service satisfaction based on passenger perception in Beijing.

In contrast to our research, we proposed a mobile application tool to collect the information in real-time that may contribute to express bus accident based on the perception of express bus's passenger. The analysis of the data will also be done real-time in the cloud and can be monitored by stakeholders. We also add SOS capability to aid for emergency incident.

METHODOLOGY

The development of the mobile applications follows ADDIE (Analysis, Design, Development, Implementation and Evaluation) model. The ADDIE framework is a cyclic process that evolve overtime and continues throughout the process. In analysis phase, we have collected factors that contribute to express bus accidents (Hassan et al, 2018). The factors were then clustered into six main attributes, i.e.; Service performance, comfort, experience, safety, knowledge on safety and information technology system. The needs analysis was also conducted and has been reported in Hassan et al. (2018). In the design phase, we design the framework as given in Figure 1. The bus assessment framework consists of two main parts. First part is a web portal for admin to check the assessment report, to manage the diver and trip information. Second part is a mobile app target on the passenger to gather their feedback about the bus condition and the driver behaviour. Other than that, passenger can communicate with the bus company in case of emergency through the app.

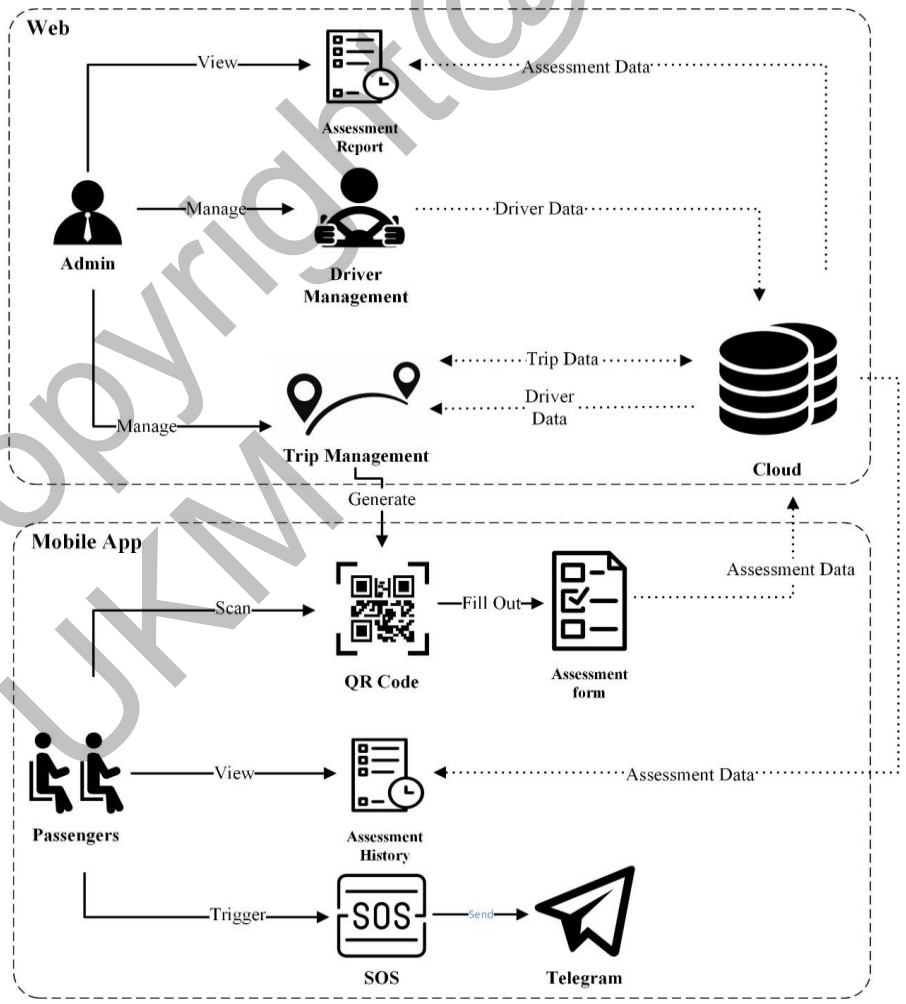

FIGURE 1. Bus assessment mobile application framework

For the assessment module, we design the context diagram of the assessment application as in Figure 2. The Context Diagram shows the system under consideration as a single high-level process and then shows the relationship that the system has with other external entities. After the passenger open the application, the application will display the assessment question by scanning the QR Code. By scanning QR code, the application will display the bus information, driver personal information and able to answer the assessment question. Passenger could check the assessment that have been done via history report. Other than that, passenger can send a SOS message by just clicking a SOS button inside the application. While admin can view the assessment report, update the bus, driver and trip information as well as receive the SOS message from the passenger.

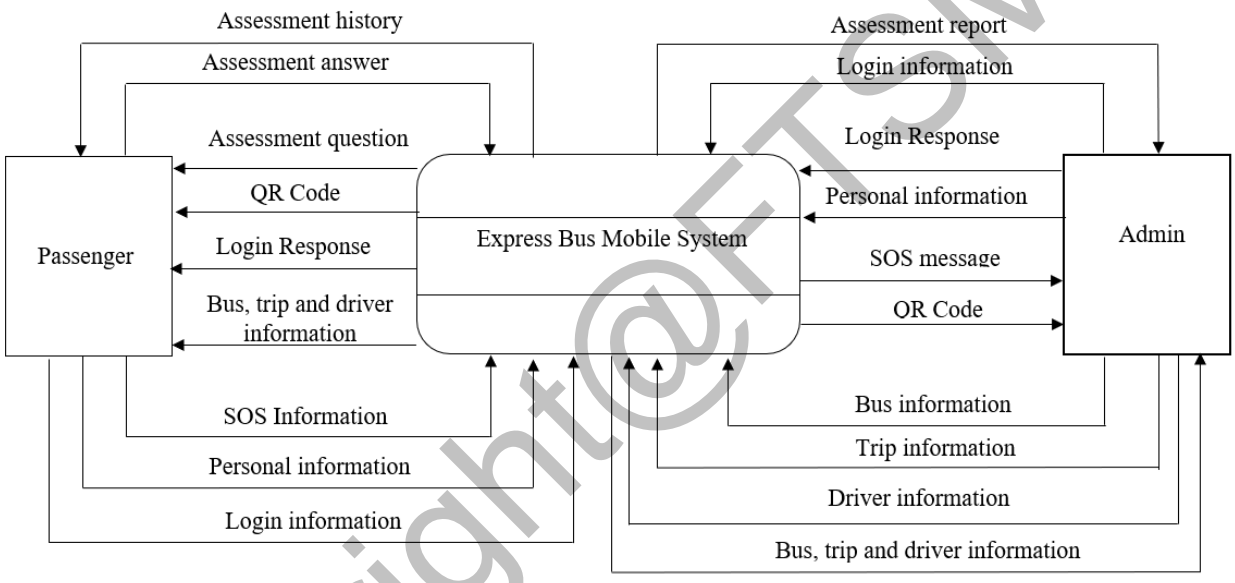

FIGURE 2. Bus assessment context diagram

Database is the heart of data management for a software system. Relationships between data need to be well organized. Data abstraction for the application is modelled via Entity Relationship (ER) model. To produce high quality database design, ER model should be fully utilized. Figure 3 show the ER model for bus assessment application data modeling. The core table include the user table which contains information about the passenger and admin. Bus table stores the bus information includes plate number, company name and trip information. Driver table created to store the driver information and the report table stores the assessment question and answer.

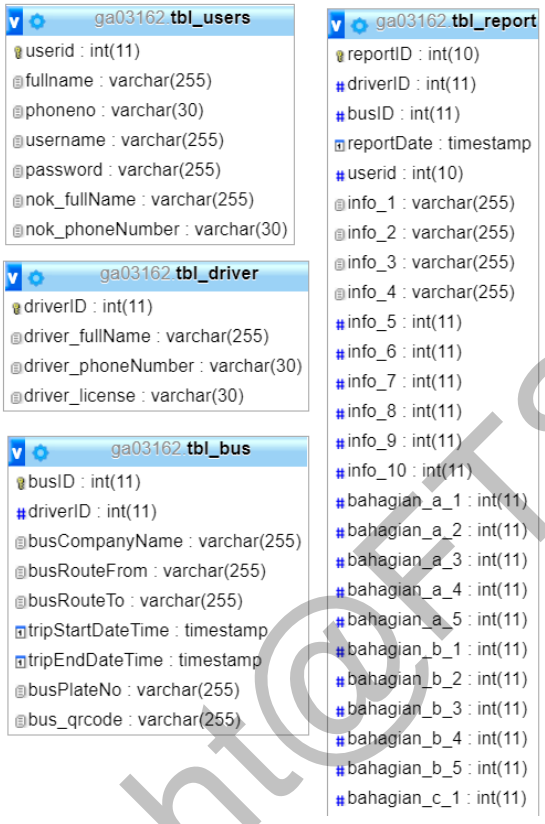

FIGURE 3. Entity relationship model for bus assessment mobile application

Figure 4 shows the data flow diagram for the bus assessment mobile application. It consists of two entities which are passenger and admin; thirteen processes: save user information, verify user information, save bus information, save driver information, save trip information, display bus, driver and trip information, generate QR Code, display assessment form, save assessment answer, generate report and generate SOS message; six storages: user information, bus information, driver information, trip information, assessment information and SOS information. The main module of the application for the admin is to check the bus assessment report. Admin can login into system via the login account process which the input (username and password) from admin is validated with the information in the user information storage. After admin has login into the system, admin can save and update the bus information along with trip information and more importantly is to check the bus assessment report. The bus assessment report was created through the generate report process, the source of data was from assessment information storage which has go through the process of save assessment answer. If any incident happened to the bus, passenger can use the mobile application a SOS message which this message will be received by the admin in a telegram channel.

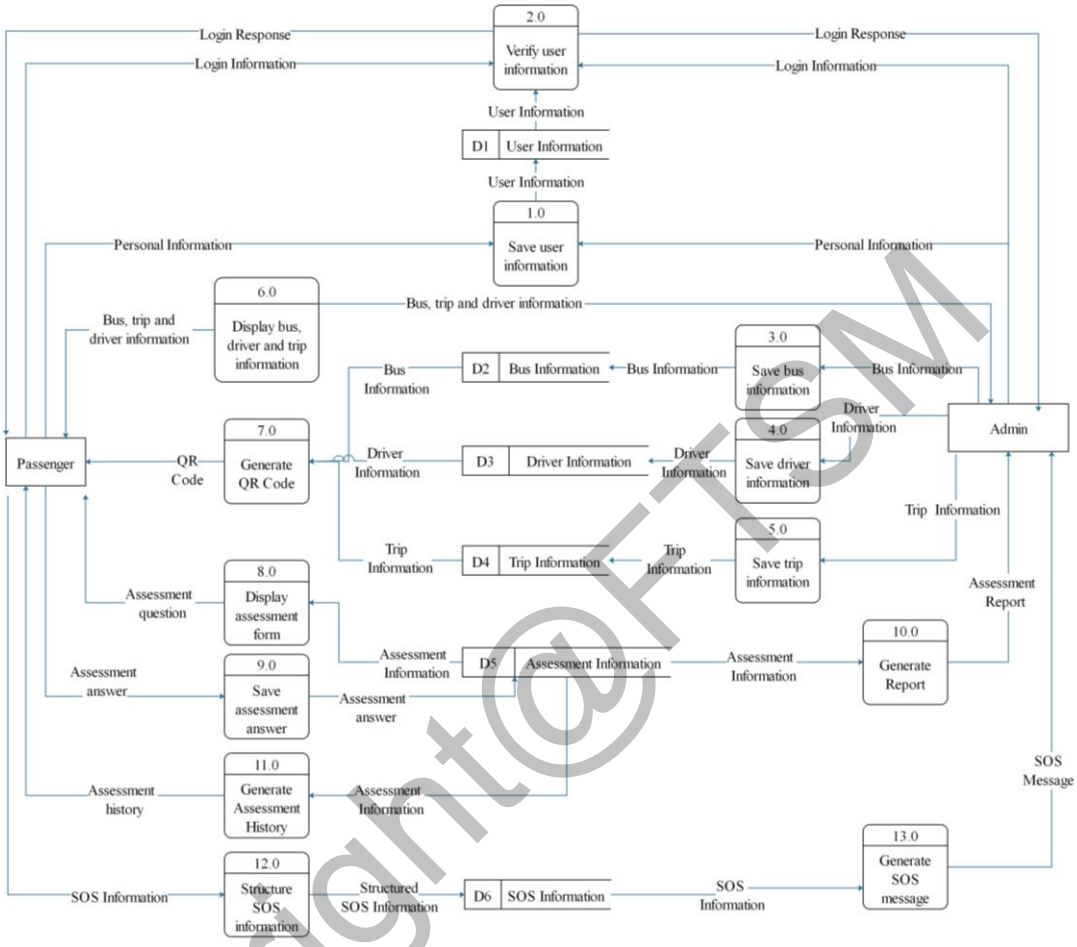

FIGURE 4. Data flow diagram for bus assessment mobile application

Figure 5 shows the process of assessment. The assessment flow is simple and easy to be done. Passenger can use the mobile application to scan the QR code which will be placed and showed inside the bus. The QR code is linked to the information about the bus, trip and corresponding driver on that trip. After passenger has scanned the QR code, the related trip information will be showed up as well as the assessment form. The assessment form contained the question about the factors that we have collected during initial phase. To answer the question, passenger only need to select the check box and click the submit report button. Then the information about the trip and the answer will stored in the database for report generating purpose.

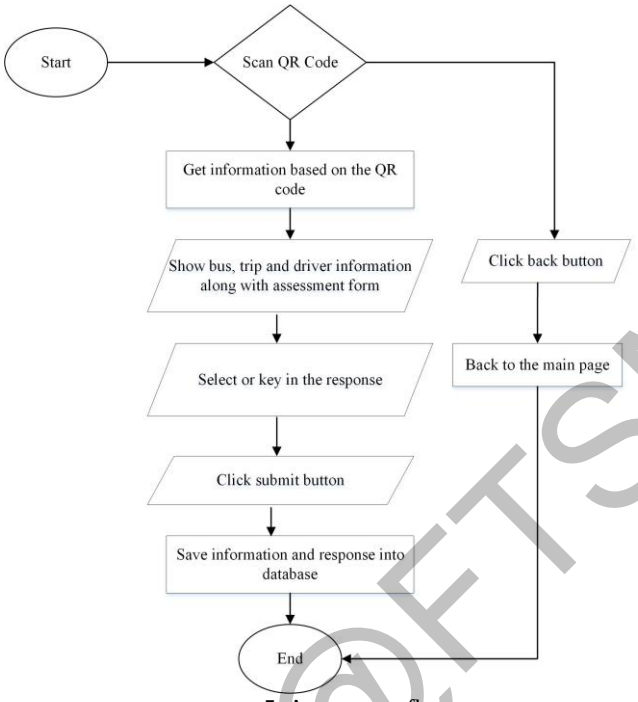

FIGURE 5. Assessment flow

RESULTS

In the web portal, information such as driver name, phone number and license are gathered via driver management module. Then the driver information is stored in the database and pass to the trip management module. Hence, the trip management module able to show the driver information via a drop-down list. The trip information includes bus plate number, departure and arrival destination as well as departure and arrival time. The unique function in the trip management is the QR code generator which it can generate the QR code related to the trip and to be used by the passenger later (Figure 6). Other than that, Figure 7 shows the admin can check and analyses the assessment report which it is generated from the passenger input about the bus condition and the driver driving behaviour.

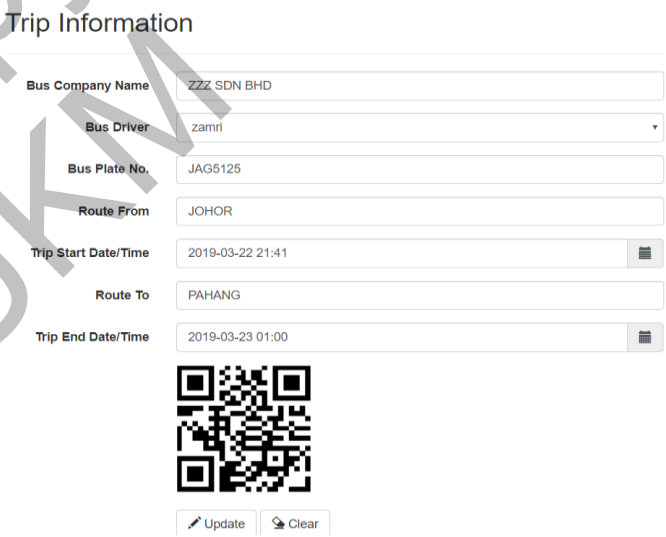

FIGURE 6. Trip Management module with QR code generator

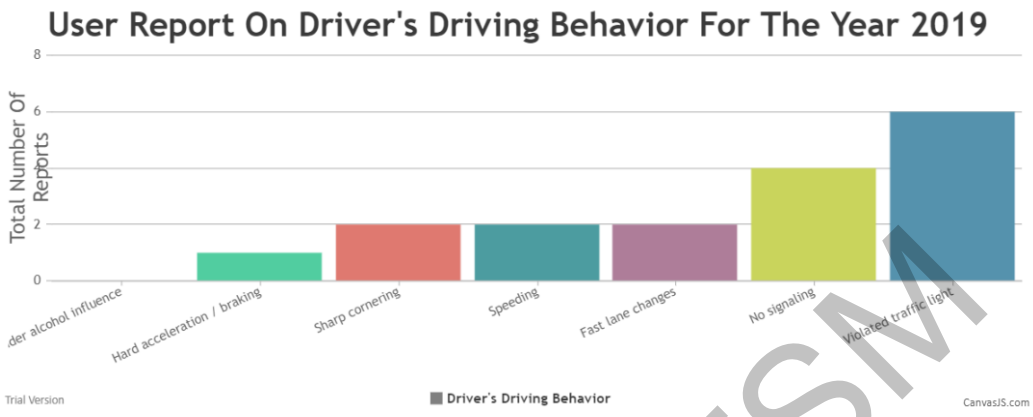

FIGURE 7. Assessment report analysis

For the mobile application, the passenger can scan the generated QR code to get the basic bus and driver information related to the trip. Besides that, an assessment form will be appeared for user to key in their feedback about the bus condition they noticed such as the worn tires, mirror is not clear etc. and the bus driver driving behaviour such as speeding, sharp cornering, sudden brake etc. as shown in Figure 8. Passenger perceptions are gathered via this assessment form (Figure 8). The passenger also can check back their previous feedback record through the application as shown in Figure 9. Figure 10 shows the SOS module in the app which the passenger can have a one-way communication with the bus company. A simple message can be sent by passenger via the SOS module. The app will automatically detect the current location of the passenger and the location information will be sent along with the message to the bus company telegram emergency channel.

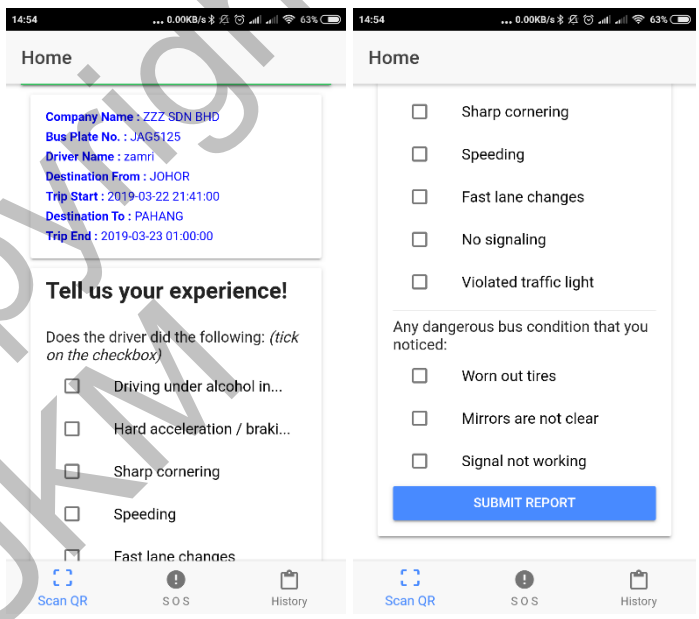

FIGURE 8. Bus information and assessment form

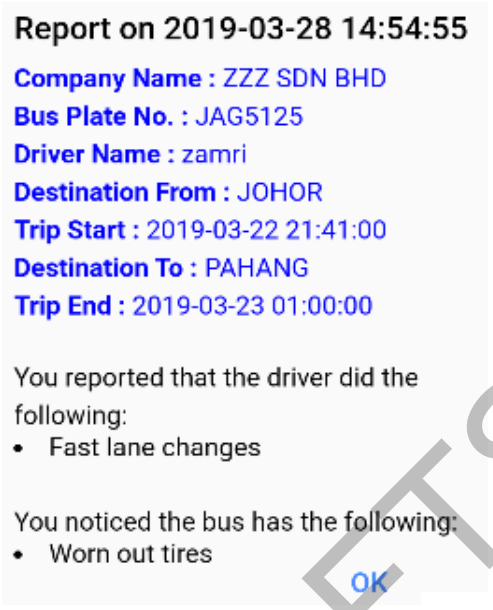

FIGURE 9. History of Assessment report

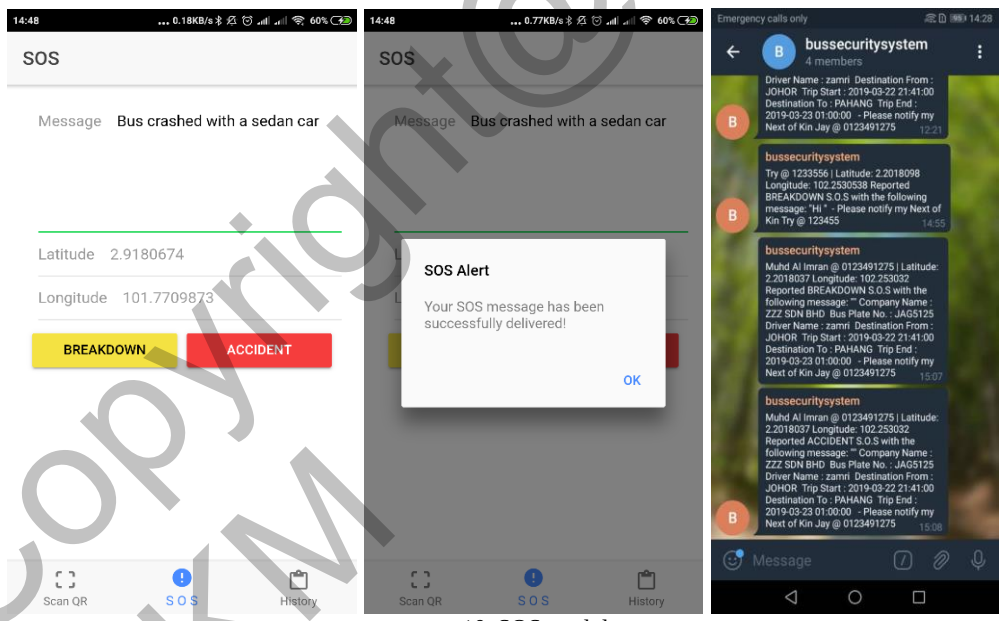

FIGURE 10. SOS module

CONCLUSION

The bus assessment framework based on the passenger input could reduce the fraud report that totally depend on and generated by the bus company itself. In the same time, the bus company can monitor their driver with the help of the crowdsourcing method that based on the input from the passenger. We believe the bus assessment framework could be a compliment tool in the existing bus express monitoring or rating system. With this monitoring method, the quality of the bus company can be assessed and improved. Hence, it will help to reduce the accident of the bus express on the road. Clearly, there is a room for improvement. In the future, we will do a thoroughly research to come out a rating system to evaluate the quality of a bus express system. The rating system should have cover different aspects of the bus express quality not just the bus condition and the drive driving behaviour only.

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