Cloud computing architecture for evaluating courier driving capability in express courier services

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Abstract

The Cloud Computing System presented in the paper deals with the assessment of the possibility of safe courier driving in express courier services. Express courier services strive to ensure delivery with as few losses as possible with maximum efficiency of the courier delivery. The proposed system is based on Cloud Computing architecture, and is intended for evaluating the possibility of courier driving. The most important part of the system is the evaluation of the courier's current driving capabilities based on eye parameters. Using pupil/iris parameter sizes, the system recognizes unusual conditions of the courier's eye. Detected unusual conditions of the courier's eye can indicate the potential use of narcotics, medications, fatigue, depressive states, etc. The Cloud Computing System is tasked with real-time assessment of the courier's ability to drive the vehicle and based on that assessment makes recommendations. Recommendations are sent to the Supervisor of the Logistics Center and can range from a simple warning, a request to temporarily disconnect the driver from the vehicle, to a recommendation to completely disconnect the driver from the vehicle for a longe time.

Keywords*: Courier; Express courier services; Courier driving capability; Cloud Computing System, Courier Services System.*

1 Introduction

Globalization in the world, technology development and ubiquitous computerization generate new challenges that express courier services must face. Service providers must not only continuously react, adapting to market expectations, but also take proactive measures [1].

One of the biggest recorded problems within courier services is damage caused by couriers while driving. Couriers mostly cause damage to vehicles and goods being delivered by their own carelessness, lack of training and current driving capabilities. The carelessness of the courier happens at a certain moment, so it is not always completely controlled by the driver and it is difficult to eliminate it. Lack of training is strictly controlled and can be remedied through additional courier driver training. The most interesting topic to consider is current driving capabilities that can be avoided by eliminating couriers from the delivery system. The evaluation of the courier's current driving abilities can be made based on the recognition of deviant conditions of the driver's eye. As part of the assessment, the narrowing or expansion of the pupil/iris can be monitored when drivers take drugs, drink alcohol, consume certain types of medication, are tired, depressed, etc. The goal of this research is to create a Cloud Computing System that evaluates the courier's current ability to drive. The results of the assessment could be used in terms of sanctioning couriers by excluding them from traffic, and thus protecting people and goods. The system presented in this paper is used to assess the current driving abilities of professional drivers. Couriers are drivers of trucks, vans, cars who transport goods. They are also responsible for taking care

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of their vehicle, cargo during transport. Often, the safety of people and goods depends on the immediate ability of the courier to drive the vehicle. Therefore, there is a need to test the current driving capabilities of couriers in express courier services on a daily basis. Employers of transport companies strive for the maximum efficiency of couriers in their work, in order to ensure the safe transport of goods. Therefore, the current ability to drive vehicles is of great importance for people's life and work.

The paper is structured as follows: the first part contains an introduction to the issue. The second part deals with thematic considerations in courier driving possibilities. The third part describes the system for assessing the courier's current ability to drive a vehicle. The fourth part refers to the Cloud Computing System for evaluating courier driving capabilities. The fifth section deals with the results and the discussion of the presented results. Concluding remarks and future research developments are presented in the sixth section.

2 Courier driving capability in express courier services

Traffic accidents with unfavorable outcomes and material damage are a frequent occurrence in the Courier Services System [2–4]. Traffic accidents in express courier services are mostly caused by drivers (couriers). In order to reduce material damage to delivery vehicles and goods, and reduce delivery time, express courier services must improve the knowledge and skills of couriers. However, traffic accidents are not only the result not of the courier's training but of the courier's current condition. It is very difficult to recognize courier driving capabilities at the moment of picking up the delivery vehicle. Recognizing hard-to-predict courier driving conditions can save many lives, reduce material damage, and improve the operation of express courier services.

2.1 Courier driving capability under the influence of alcohol

One of the methods of assessing the driving capabilities under the influence of alcohol is based on the recognition of deviant conditions of the driver's eye [5–7]. Practical experience shows that eye damage occurs even with minor alcohol consumption. When alcoholism becomes chronic, vision problems worsen:

- Reduced visual perception of the environment. The brain is responsible for the organs of vision, and alcohol gives it a big blow. The main symptoms of the pathology are blurred vision, split image, slowing of visual reaction.
- When alcohol enters the body, the driver begins to react more slowly to light, the pupil of the eye expands.
- The quality of peripheral vision is reduced. Prolonged drinking of alcohol leads to a decrease in sensitivity.
- Dilated pupils perceive contrast less well.
- A person suffering from alcoholism is more likely to undergo optic neuropathy. In the presence of this pathology, vision is often lost, the perception of the color of the environment decreases.
- Frequent migraines are possible.

From the above, we can conclude that the influence of alcohol on a person's vision significantly reduces functionality in everyday life [8].

2.2 Courier driving capability under the influence of medicines and narcotics

Without a deeper analysis, it is difficult to recognize a delivery courier who is under the influence of medication and drugs, but the aforementioned influences can have bad consequences for the courier's driving capabilities. The content of drugs and some types of medication relaxes you, usually makes a person happy or alert, however it not only manipulates neurotransmitters in your brain, but can also affect physiological processes in your body. They also include the eye muscles that are responsible for dilating or constricting your pupils [9]. After using cocaine, marijuana, or amphetamines, your pupils are noticeably wider, while drugs like heroin will cause your pupils to constrict [10].

A change in the size of the pupils does not always have to be a sign of drug consumption. Pupils can be dilated if a person has epilepsy and takes medication, is scared or tired. Regardless of whether the driver is a drug user, a drunk person, a person who has epilepsy or is taking medication, for the safety of other people, it is necessary to exclude such persons from traffic.

3 Assessment of the current driving capability of courier

The paper is based on the development of a Cloud Computing System for assessing the current ability of couriers to drive a delivery vehicle. The most important part of the system is the assessment of the current driving capabilities of the courier based on eye parameters from the courier's image [11]. The system detects 2 areas of the eye (iris/pupil) [12]. Recognition is done using the geometric properties of the eye [13]. The success of recognizing the iris/pupil of the eye based on the courier image depends on: the quality of the courier image, the angle of the courier's eye (open/semi-open) and (front side/corner), and the lighting regime at the time of image formation and other factors [14].

Based on the comparison of the relationship between the iris and the pupil from the real-time image of the courier and the image of the same courier taken from a previously formed data set of all employed couriers, the system provides an estimate of the courier's current driving ability.

The result of the assessment is a text message that is forwarded to the dispatch center to the Supervisor and can read "The courier is able to drive the vehicle" and "The courier is not able to drive the vehicle". The assessment of the courier's current ability to drive a vehicle may be wrong if the driver was under the influence of alcohol, narcotics, prohibited drugs, etc. during the first photo shoot.

Lack of judgment can be avoided by paying attention to the courier's behavior before taking the first photo.

4 Cloud Computing System for evaluating courier driving capability

The Cloud Computing System (CCS) can serve several logistics centers at the same time. CCS is intended for data collection and processing. The assessment of the courier's ability to drive is carried out for each courier individually within the framework of CCS. Data collection, i.e. the initial photographing of the courier at the time of reporting for duty, is carried out in the logistics center to which the courier belongs (Figure 1).

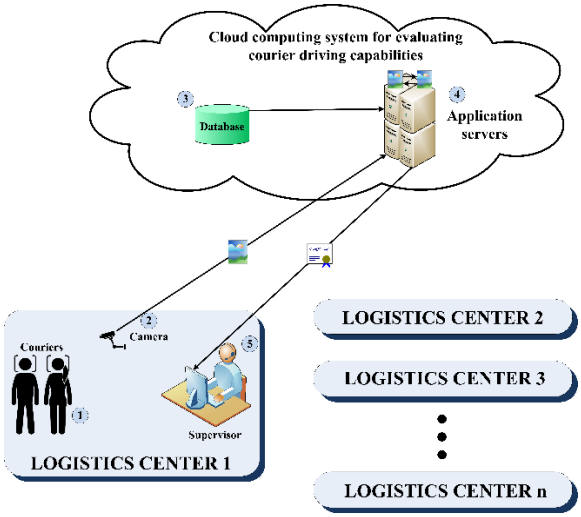

Fig. 1. Cloud computing architecture for evaluating courier driving capability

The CCS system consists of the following elements:

1. Couriers reporting to work at Logistics Center 1.

2. The camera used to photograph the courier at the time of reporting for duty.

3. Database of Initial Images of couriers from all logistics centers at the time of employment.

4. The application server is responsible for processing incoming images, processing and evaluating courier driving capabilities.

5. The supervisor, on the basis of evaluating courier driving capabilities, makes a decision to exclude the courier from the delivery system.

Within the logistics center, couriers are photographed when reporting for duty (Initial Images). Initial courier images taken according to special conditions, shooting angle, lighting, etc. they are sent for processing to the Application Server located in the cloud. Processed Initial Images of couriers are compared with images of couriers taken at the time of their employment. The aim of the comparison is to detect deviant states of the courier based on eye parameters (iris/pupil). As soon as the deviant condition of the courier is observed, the information is sent to the Supervisor, who decides on the exclusion of the courier from traffic.

5 Results and Discussion

In order to determine the validity of the CCS system, a prototype model for the object-oriented process was created (Figure 2).

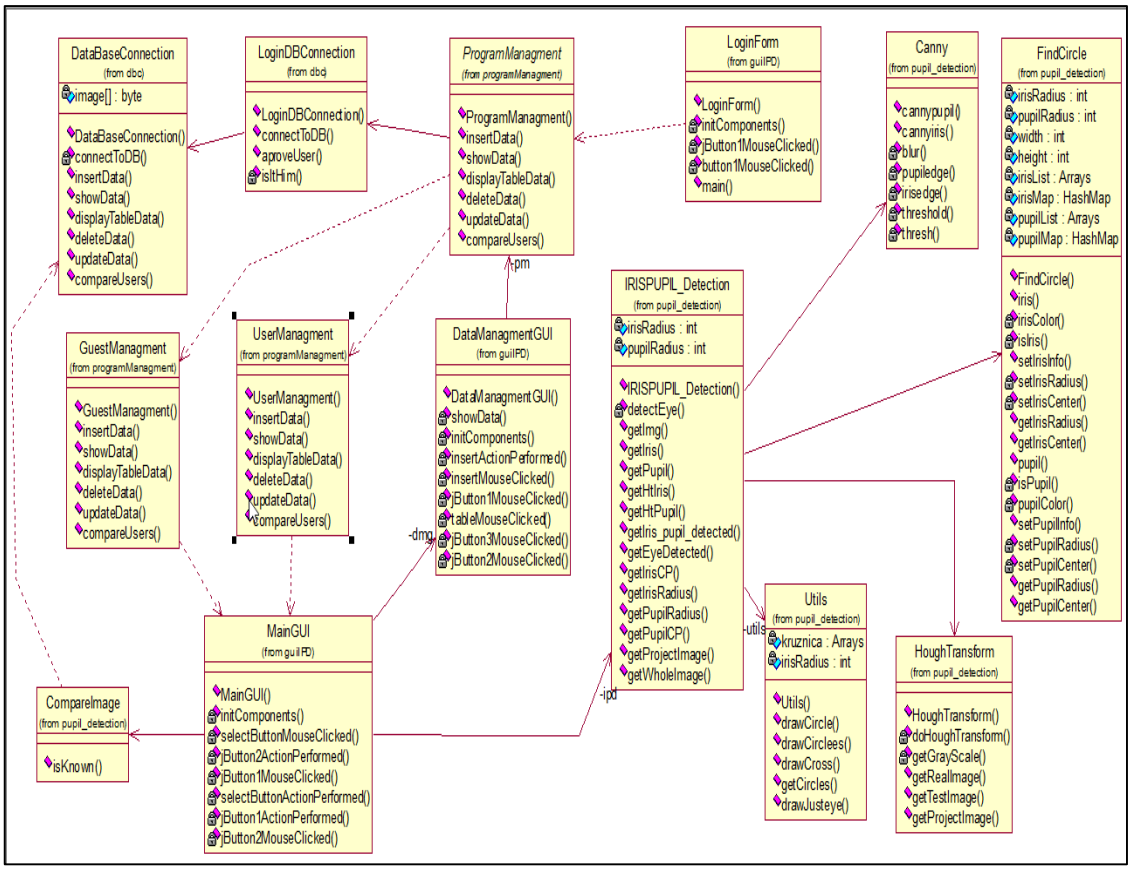

Fig. 2. Class diagram of the CCS prototype

The class diagram (Figure 2) represents an object-oriented presentation of the prototype model presented in the Unified Modeling Language (UML). Based on the generated class diagram in Figure 2, we can see the structure of the software, which has the function of simulating the operation of the CCS . When we start the software, we get a Graphical User Interface (GUI) with a LogIn form in the form of the LoginForm class, which immediately calls the ProgramManagment class, which manages the database in the background (using the LoginDBConnection and DataBaseConnection classes) and assigns privileges to users. In the case when the user is registered, this class is inherited by the UserManagment class which calls the main user interface MainGUI with the privileges of detecting pupil/iris parameters on the provided image using the IRISPUPIL_Detection class, which has a segmentation function and works with the Utils, HoughTransform, Canny and FindCircle classes. Comparison of the detected image with the Initial Image is performed in the database using the CompareImage class and entering the detected image into the database using the graphical user interface DataManagmentGUI, which again works with the database using the ProgramManagment class. In case the user is not registered, his only privilege is to detect pupil/iris parameters from the image obtained at the entrance.

The results of the CCS depend on the estimation of the parameters of the courier eye. The assessment of the detected deviant condition is forwarded to the Supervisor of the logistics center. However, the assessment of the current ability of professional drivers to drive a vehicle can be wrong if the driver was under the influence of alcohol, narcotics, illegal drugs, etc. on the Initial Image. A lack of judgment can be avoided by paying attention to the behavior of the courier when taking the first photo. Evaluating courier driving capabilities largely depends on the detection of the courier's eye parameters, that is, the conditions and quality of photography.

6 Conclusion

The Cloud Computing System presented in the paper is designed for application in the field of express courier services, but it can also have some

other use. The validity of the CCS system was tested by designing a prototype model for an object-oriented process. The system recognizes the parameters of the pupil/iris of the eye from an Initial Image, which is a big advantage compared to other similar systems. The disadvantage of the system is that the image must be taken under predetermined conditions, and therefore the image must be taken in a specific place and at a precisely defined angle and lighting. Based on the size of the pupil/iris parameters, the system recognizes unusual conditions of the courier's eye that suggest to the Supervisor that the courier should be excluded from traffic. Also, the system can evaluate the driving skills of couriers in several logistics centers at the same time.

In future research, the Cloud Computing System can use a neural network to detect deviant courier states. A neural network could perform an automatic classification of deviant states of couriers with the possibility of giving a prediction for the exclusion from traffic.

Also, CCS could be improved so that iris/pupil detection results can be applied in eye tracking systems that use biometric systems. Based on this, a fast and accurate system for real use would be created, which would be based on a hardware-software platform that would be used for that purpose. One of the roles of such a system could be to assess the delivery courier's ability during the entire delivery route, and not only at the starting point of the route when the courier starts driving. The CCS would be tasked with real-time assessment of the driver's ability to operate the vehicle and based on that assessment make recommendations. Recommendations sent to the Supervisor of the Logistics Center can range from a simple warning, a request to temporarily disconnect the driver from the vehicle, to a recommendation to completely disconnect the driver from the vehicle for a long time.

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