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Prototype of Drowsiness Detection For Drivers Using Facial Recognition

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Abstract *— In this study it was observed that many drivers have had difficulties in resting their full hours at least 8 hours, which is recommended for this reason a prototype of mobile application was proposed to help drivers who present these problems through information processes. The methodology that will help how to develop this application will be the Scrum methodology because it is adaptable according to the profile that is being required and easy to adapt to the constant changes that will arise in the process of its development, given the large number of accidents, which arise daily requires an absolutely fast delivery with the necessary resources that the application requires, with the efficiency in the response time to an eventuality, because in the long stretches, fatigue and sleepiness are caused by traffic accidents on the roads of Peru, Acute sleep deprivation, night driving habits, prolonged hours without the required rest, alcohol consumption, untreated sleep disorders, these are the symptoms that drivers often have, of course is progressively decreasing their ability to attention and concentration while driving, making you lose the ability to respond to specific conditions that require immediate reactions when going on the road, blinking or drowsiness when driving expresses a high level of fatigue and sleep. The accidents produced by the circumstances described above have a high degree of accident rate in terms of passengers killed, injured and material losses. And so it will be of great result and benefit to maximize the increase in vehicle safety and to be able to implement it in different vehicles.*

Keywords *— Vehicle drivers, Scrum methodology, drowsiness, facial recognition.*

I. INTRODUCTION

The lack of any organization of a system of control over The lack of any organization of a system of control over traffic accidents, where the different factors that lead to the risk of losing one's life and causing material damage can be analyzed, by carrying out long stretches without any rest and with the pressure of time among other factors [1].

According to a worldwide report on the prevention of traffic accidents, it is estimated that between 35 and 45% of the adult population over 18 years of age has shown that drowsiness is present in 19% of the female population and 17% in men, therefore the objective is to detect the risk of drowsiness in the adult population of metropolitan Lima and analyze them in order to obtain information, in order to develop safety strategies [2].

We found several methodologies for the development of the mobile application, so we will work with the agile methodology, also called Scrum methodology. Adopting agile techniques to promote vehicle safety and for a better understanding when developing applications [3]. Agile methods also facilitate processes where changes are accepted at any stage. This implies changes in the development [4]. Finally, for the development of the Balsamiq user interface, since it is useful for a fast construction of interactive models, it is possible to identify ideas of how it can be changed through the development process, fulfilling the objective [5].

This article will use a mobile application platform to analyze information on drowsiness in metropolitan Lima in order to reduce accidents and increase road safety by protecting human life and property damage.

The objective of this research work is to help citizens, with vehicle safety by reducing accidents caused by drowsiness, with this study information made, will help us to prevail and reduce material damage and save lives.

The current work is structured as follows, in point number 2 will describe, the methodology that has been used for the development of the mobile application. In point 3, the results obtained will be finally demonstrated, reaching point 4 where the results of the development will be discussed and a conclusion will be reached.

II. METHODOLOGY

For this prototype we will use the Scrum methodology because it will provide the necessary tools for the delivery of value in short periods of time, this methodology to achieve the objectives mentioned is based on three pillars transparency, inspection and adaptation [6].

A. Scrum Methodology

Iterative and incremental framework for the development of projects, products and applications It structures the development in work cycles called Sprints. They are iterations of 1 to 4 weeks, and they follow one after another.

Sprints are of fixed duration and end on a specific date, even if the work is not finished, and they never get longer. They are limited in time. At the beginning of each Sprint, a multifunctional team selects the items (customer requirements) from a prioritized list. They commit to completing the items at the end of the Sprint. During the Sprint, the selected items of the Scrum process cannot be changed [7]. As shown in Figure 1.

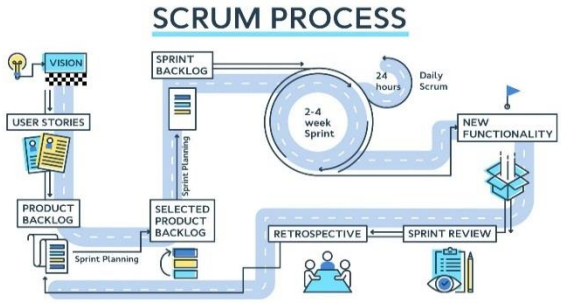

Fig. 1 Process Scrum

The Scrum methodology also provides details of each process with well-defined iterations and tasks. The following phases to be used in the Scrum methodology will be detailed.

***a) Sprint planning*:** At this stage, we will select the prototype's backlog, the functionalities that will be worked on and that will give value to our prototype. The meetings that will be held will result in a list called Sprint Backlog with the tasks, estimates and work assignments to the team for the development of the functionalities [8].

At this stage, the Product owner, ScrumMaster and the entire Scrum team will participate in this meeting, where the top priority features will be planned and described, with the necessary questions to be able to understand some aspects so that they can be converted into high-level user stories for the Product Blacklog organized as shown in Figure 2.

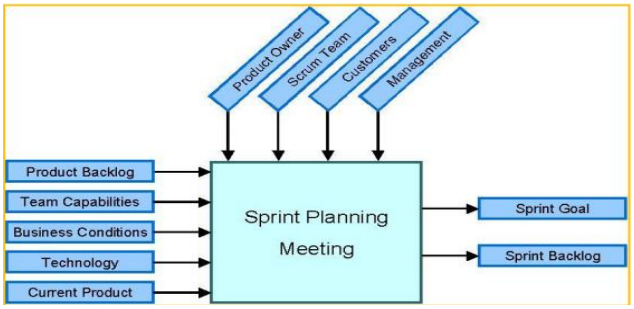

Fig. 2 Sprint Planning

***b) Development Stage*:** In this stage, an increase of the prototype will be achieved, which will be productive, the time estimated will be 2 and 4 weeks. During the execution of the sprint, planning meetings will be held to define the tasks and objectives [9].

In the daily meetings, information about the development of the prototype will be shared and necessary adaptations will be made to increase productivity [10].

Then, meetings will be held to review the sprint where the deliverable prototype to be implemented will be presented, the delivery will be analyzed and the team will report the problems that were encountered in the process of developing the prototype.

***c) Sprint Review* :** This occurs at the end of the development of the Sprint with the duration already estimated for the progress of the prototype is at this point where the progress is also verified and will identify what was not done in turn shows how the prototype works and the problems that were found in order to prioritize them.

d) Comments: The development of the prototype will be retrospective with it will be carried out the taking of decisions since they will advance to the evidences and experiences in this stage can be determined with accuracy the deficiency of the prototype to be able to improve it this way it is clear that the sprints in this stage are effective and agile.

B. Design and tools

In the tools will be used the Rasbperry pi this board will be selected for the development of the prototype because it has the necessary specifications as RAM memory, access to ETHERNET and Wifi [11]. This board will incorporate all components of the prototype as the Raspberry camera. This Raspberry camera will allow capturing and processing images of the driver, it has a frame per second and the processing speed makes it suitable for the prototype, as shown in Figure 3.

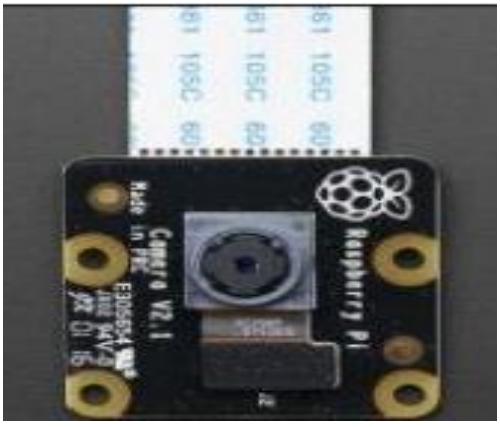

Fig. 3 Pi Noir camera

In addition, proximity sensors will be incorporated in the Raspberry board since they detect objects at considerable distances according to the reprogrammed or calibrated that will help generate information for the development of the prototype [12].

It will also have a Buzzer device that will be able to alert the driver by means of a buzzer or sound when he enters in a drowsy state. All these tools are incorporated in the diagram of the drowsiness detection circuit, as shown in figure 4.

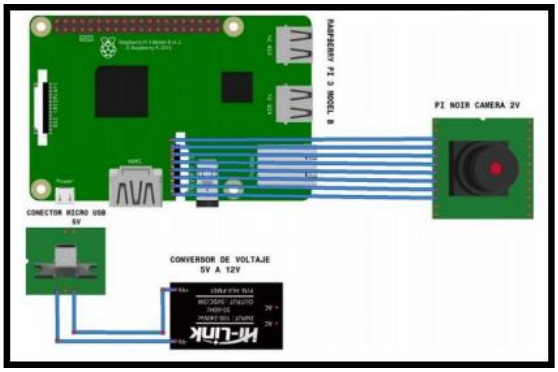

Fig. 4 Sleepiness detection circuit diagram.

For the development of the algorithm, the OpenCV library will be implemented. This library is an image recognition application development software, which will allow us to recognize the physiological features presented by the driver of the vehicle, through a 3D relief scan, since it has a library and an algorithm that will identify the driver's features [13]. This library will be implemented in the Visual Studio Code platform with the Python programming language. This language offers us options for structuring code is easy to understand and the way to structure the code is through an indent that will be applied [14], allowing the development of algorithms that gives us the OpenCV library. The information obtained from image captures and drowsiness characteristics will be stored in a SQLSERVER database.

After the corroboration and the type of elements with which the prototype will work, the proximity sensors will be implemented in the vehicle, being directly communicated with the Raspberry plate. This plate will also send the information to the vehicle's computer, which will allow taking actions in an intelligent way due to the alert information received by the facial recognition that detects, according to established protocols of the symptoms of fatigue and at the same time acting in case of a possible accident [15]. As shown in Figure 5.

Fig. 5 Sleepiness alert

In addition, for the development of the prototype of the application it will be modeled with the Balsamiq tool.

C. Procedure

a) Product Stack: At this stage the Product Backlog organized as a list ordered by value and priority needs the requirements that are already defined and this will evolve during the project.

b) Sprint Backlog: The Product Backlog task list is organized and identified, the user stories that describe the functionalities that make up the project, these lists are defined in the Sprint planning meetings.

c) Planning Meeting : Planning meetings are prioritized by task and monitored by the Product Owner

III. CASE STUDY

At this point you will deploy the planning of the already mentioned Sprints represented in modules with their respective estimates of the time it will take to execute it in the prototype stage.

A. Sprint Planning

- As a user I want to enter the login to be able to enter the platform.
- As a user I want to visualize the event logs in order to see the history of movements by GPS
- As a user I can add contacts from my directory so they can be alerted to an event
- As a user I want to store the facial characteristics of people, and the internal components of the vehicle in order to have information regarding possible sleepiness problems.

B. Stage of development

***a) Time estimate*:** At this point we will see the duration of each Sprint and its development time, with this estimation we will be able to determine how long it will take to develop the prototype and to be able to determine how much time we will be able to obtain the minimum indispensable so that it can already be in operation and to be able to determine which aspects can be improved or to place them as indispensable, as shown in table 1.

TABLE I: DURATION OF SPRINTS

Module	Duration
Sleepiness mobile application	3 months
User module	2 weeks
Reporting Module	2 weeks
Information storage module	2 weeks

***b) Prototype of the mobile application*:** At this point we will visualize the creation, the design of the prototype we made and detail their respective functions.

In addition, the prototype of driver drowsiness detection will provide necessary information through an application and web platform specifying the exact location of the vehicle, to the contacts that are associated with the driver.

Likewise, the prototype will send information about the status of the vehicle and the driver who occupies it, also with the complement of the circuit that will carry the car as part of the development to optimize the functions provided, as shown in Figure 6 and Figure 7.

Fig. 6 Reporting module

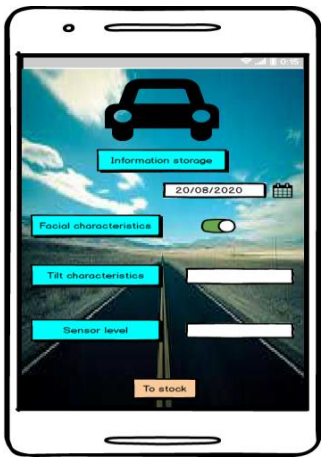

Fig. 7 Information storage module.

c) Increase of the modules: At this point we will detail the functions of the modules in turn each process that takes to develop in order to complement the priorities set for a minimum continuous operation and subject to development changes as shown in the following Increments.

***Application process*:** This increment will represent the start of the application and the development of the interface layers to interact easily and continuously with the user.

***User module* :** In this process we will detail how the prototype will be developed at the user level of the login.

Reports Module: This increment will show the reports of each incident that is presented and which will be stored to be able to visualize them in detail.

Information Storage Module: This increment will store information regarding the evidence of possible incidents to be able to have more precision in the time of acting.

C. Stage of development

What was done of the prototype will be done, what was not done will be identified and the first deliverable orincrement will be discussed, the problems found and the way they were solved will be detailed. This meeting is of great importance for the following Sprints [16], as shown in Table 2.

TABLE II: SPRINT REVIEW

Increase	That Was Done	That Was Not Done	Problems That Were Had
Application process	BackEnd Development	Reports and alerts	Short time for development
	Development of the FontEnd.		
	Database Development		

IV. RESULTS AND DISCUSSION

A. About the case study

As a case study, the development of the mobile application is done with effort and delivery, with the purpose that the user sees the application as the best way to take care of their vehicle assets and their lives with an easy interaction of the application.

A comparison with other research works shows that the designs of the prototypes do not have the functionalities that they really should offer for a better handling of the application, and they do not have their components installed in the vehicle, since they are essential to be able to go hand in hand with the application [17].

Research, insofar as some prototypes have contributed, has shown that in general it has not been possible to reduce the number of deaths in traffic accidents, in other words, the contributions are not entirely effective and this can be represented [18]. In the following Figure 8.

Fig. 8 Historical evolution of deaths in traffic accidents.

Comparing with the research work of the intelligent alarm prototype using gsm/gps for monitoring vehicle incidents developed at the Autonomous University of Peru that is more similar to our development of the prototype we can verify that it does not have accessories that are installed in the vehicle contributing to the security system that is what is needed to safeguard human life and avoid material damage [19]. shows what one prototype has and the other does not, as shown in table 3.

TABLE III: SPRINT REVIEW

totype of drowsiness detection for drivers using facial recognition	Prototype of intelligent alarm using gsm/gps for monitoring vehicle incidents
Use of facial recognition	NO
Use of platform design	NO
Use of electronic components	YES
Use of proximity sensors	NO
Use of gps	YES
Use of contacts as external help	YES
Use of reports	NO
Storage use	NO
Use of automatic vehicle control	NO
Connection between the vehicle computer and the prototype in case of emergency	NO
Connection of the vehicle's automaton	NO
Automatic braking and steering of the automobile	NO

Through a comparison with another project we simplify that only perform the development of the application, together what we do as research and prototyping implementation attached to the vehicle is part of a plus to ensure the effectiveness of the application developed because it has tools that help solve the problems that afflict citizens in terms of road safety also generating a safer environment in the event of drowsiness.

B. About the Methodology

For this purpose, the methodology used is the Scrum methodology with its easy integration to changes and easy adaptation to possible changes in full development and incremental with the agile methodology is constantly made deliverables by testing and constantly complementing what previously could not be done with traditional models [20].

It differs in detail from traditional methodologies that previously were performed and that today there is no comparison, due to the process that takes to carry out a project concluding in how it has developed a work with efficiency and a better method of deliverables. As shown in table 4.

TABLE VI: TRADITIONAL VS. AGILE METHODOLOGY

Traditional Methodology	Agile methodology
Extensive documentation	Little documentation
Process oriented	People-oriented
Delivery of the software at the end	Constant deliveries
Poor communication with the user	Constant communication with the user

V. CONCLUSIONS

The Vehicle Drowsiness Detection System are essential tools to prevent traffic accidents, because they allow constant and real time monitoring of the driver when he is driving. This prototype of drowsiness detection that adapts to vehicles is essential for the transport of vehicles either long route because the fatigue and drowsiness is more constant in addition to being subjected to long hours of work.

Information was obtained on the use of conventional drowsiness detection systems in the country, and few vehicles have this drowsiness detection system, being those of the Toyota brand that are entering in small quantities in new vehicles.

The drowsiness detection through facial recognition is quite reliable because it has a low error rate. This is

achieved through the algorithms of the OpenCV library that is facial recognition.

In addition, the Scrum methodology will allow us to expedite the delivery of the prototype in short iterations of time because it is based on aspects such as flexibility, collaboration, iterative development and the human factor.

The use of the prototype of drowsiness detection that will be implemented will help to have a better control of the physical aspects of the driver helping to reduce accidents caused by fatigue, besides this prototype can be operated by any person prior to a slight instruction of its operation.

The drowsiness detection tests that will be performed by the algorithms will take 36.4 seconds in the recognition phase, and they also have 70% efficiency in facial recognition, concluding that this prototype can help reduce traffic accidents caused by fatigue and drowsiness [21].

With the development of this prototype, it is intended, in the future, to have the implementation of the architecture and the software in the vehicles of transport of Peru and thus to achieve the reduction of accidents caused by the drowsiness that currently causes losses in life and materials.

REFERENCES

[1] Soria, J. A. R., Reflexiones sobre los accidentes vehiculares Durante la jornada laboral y de los aportes de la psicología. Salud de los Trabajadores, 25(1)(2017) 82-86.

[2] Tlatoa Ramírez, H. M., Ocaña Servín, H. L., Márquez López, M. L., Bermeo Méndez, J., & Gallo Avalos, A. F., El género, un factor determinante en el riesgo de somnolencia., (2015).

[3] Ardakani, MRM, Hashemi, SM y Razzazi, M. (2018). Adapt the scrum methodology to establish dynamic inter-organizational collaboration. Journal of Organizational Change Management.

[4] Lei, H., Ganjeizadeh, F., Jayachandran, PK y Ozcan, P., A statistical analysis of the effects of Scrum and Kanban on software development projects. Robotics and Computer Integrated Manufacturing, 43(2017) 59-67.

[5] Permana, PAG., Implementación del método Scrum en la gestión de un proyecto de desarrollo de software. Revista Internacional de Aplicaciones y Ciencias de la Computación Avanzadas , 6(9) (2015) 198-204.

[6] Vásquez, F., & Salazar, G., Physical activity pattern in a group of obese preschoolers attending Junji kindergartens, assessed with a movement sensor. Chilean nutrition magazine, 32(2)(2005) 110-117

[7] Celin Mancera, W. E., Solano Mazo, C. A., & Molina Coronell, J. E., Plano inclinado con dos sensores para la enseñanza del movimiento rectilíneo uniformemente acelerado., (2017).

[8] Rubin, K. S., Scrum Essential: Um guia prático para o mais popular processo ágil. Alta Books Editora., (2018).

[9] Becerra, J. C. A., & Vanegas, C. E. D., Propuesta de un método para desarrollar Sistemas de Información Geográfica a partir de la metodología de desarrollo ágil-SCRUM. Cuaderno Activa, 10(2018) 29-41.

[10] Trigás Gallego, M. (2012). Metodology scrum. C. Y. Lin, M. Wu, J. A. Bloom, I. J. Cox, and M. Miller. Rotation, scale, and translation resilient public watermarking for images, IEEE Trans. Image Process., 10(5)(2001) 767-782.

[11] A. Cichocki and R. Unbehaven. Neural Networks for Optimization and Signal Processing, 1st ed. Chichester, U.K.: Wiley, 2(1993), ch. 45-47.

[12] W.-K. Chen. Linear Networks and Systems, Belmont, CA: Wadsworth, (1993) 123-135.

[13] H. Poor. An Introduction to Signal Detection and Estimation; New York: Springer-Verlag, 4(1985), ch (Book style with paper title and editor)

[14] R. A. Scholtz. The Spread Spectrum Concept, in Multiple Access, N. Abramson, Ed. Piscataway, NJ: IEEE Press, 3(1993), ch. 121-123.

[15] G. O. Young. Synthetic structure of industrial plastics, in Plastics, 2nd ed. J. Peters, Ed. New York: McGraw-Hill, 3(1964) 15-64.(Published Conference Proceedings style)

[16] BARRERA DOBLADO, O. S. C. A. R., & ROS MARIN, J. A. (2016). Sistemas eléctricos y de seguridad y confortabilidad 2. Ediciones Paraninfo, SA.

[17] S. P. Bingulac. On the compatibility of adaptive controllers, in Proc. 4th Annu. Allerton Conf. Circuits and Systems Theory, New York, (1994) 8-16.

[18] Diaz Molina, C. M., & Matthew Dominick, R. F., Prototipo de alarma inteligente usando gsm/gps para el monitoreo de incidencias vehiculares., (2018).

[19] W. D. Doyle. Magnetization reversal in films with biaxial anisotropy, in Proc. 1987 INTERMAG Conf., (1987) 2.2-1-2.2-6.

[20] Saito, Y., Itoh, M. y Inagaki, T., Driver assistance system with a dual control scheme: Efficiency to identify driver drowsiness and prevent accidents due to lane departure. Transactions IEEE in man-machine systems, 46(5)(2016) 660-671.

[21] J. Williams. Narrow-band analyzer, Ph.D. dissertation, Dept. Elect. Eng., Harvard Univ., Cambridge, MA, (1993).