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An App for the Registration of Traffic Injuries

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Abstract: We present the development of an application as a mobile tool to carry out the assessment of bodily damage suffered by a traffic accident. The scale used to assess traffic accidents can be used for any other circumstance that produces injury or bodily sequelae. The software developed will allow the expert to be guided through all the cases to generate a report where the corresponding compensation is obtained, both for bodily harm and possible disabilities. In the event of death, it also makes it possible to determine compensation to relatives and relatives based on kinship and circumstances. Of course, the role of the expert does not disappear. In many cases, forks appear, and compensation must be argued. However, this application will allow it to be operated by a physician without much experience in this legislation. The application will ask you for the details of the accident and will indicate the compensation ranges that can be applied. On the other hand, the application allows you to collect all kinds of documents that can be attached to the final report. These include medical reports and all kinds of expenses caused as an accident (hospitalization, prothesis, transportation, repatriation). A mobile application is proposed that allows automating this process, which can be used by personnel without previous experience and drastically reducing the time necessary to carry out the measurements. Another advantage is that the software runs on a mobile device using the mobile device's camera. This allows the system to be used in any location and with minimal economic cost. On the other hand, a complete patient registration system has been implemented, and the possibility of keeping a history of each one, to assess their evolution.

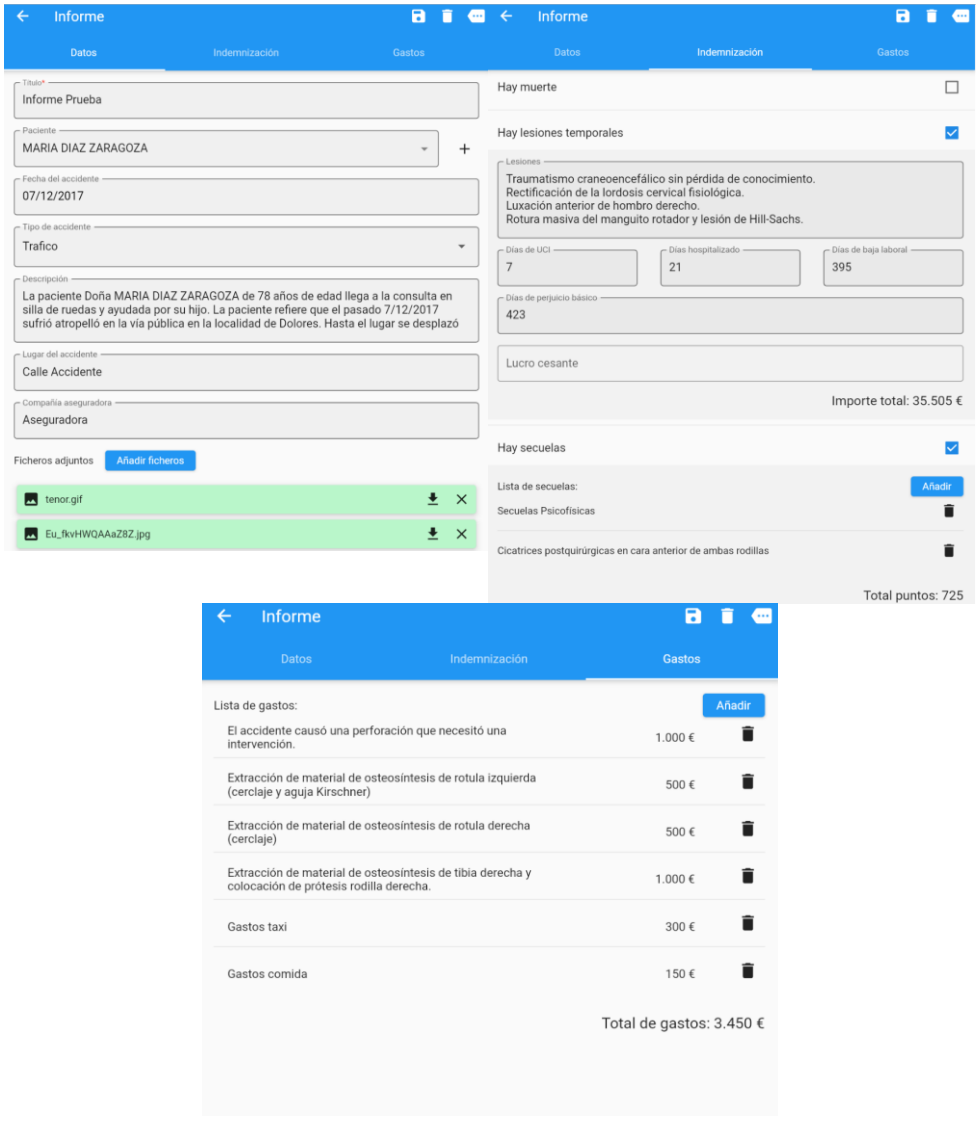
Keywords: Mobile tool, Body damage, Telemedicine

Introduction

From the beginning it was decided to develop a multiplatform application (Delia, et al., 2015) that could be used from both personal computers and mobile devices. Development platform: First, the use of the React Native tool was evaluated, as it is one of the most widely used today in the development of multiplatform applications. However, this option was discarded, the use of the Java Script programming language caused many errors at

runtime. Also, some of the libraries gave problems when switching platforms. Second, Google's Flutter tool was evaluated. It was decided to select this option, because it uses a more robust language, Dart, and because it causes much less problems with the libraries. Mobile Backend as a Services (MBaaS) (Costa et al., 2016): The development of modern applications has been boosted by the appearance of work tools in the cloud to enhance all kinds of functionalities with little effort for the developer. Solutions such as Amazon Web Services, Microsoft Azure or Google Services stand out. Firebase has been selected for this project because it has a series of advantages: Its cost is very low, it can even be zero until it reaches a significant volume of use. It is perfectly integrated with the development tool (Moroney, 2017). Last but not least, the development team has extensive experience in its use.

This application will allow it to be operated by a physician without much experience in this legislation. The application will ask you for the details of the accident and will indicate the compensation ranges that can be applied. The following screenshots show some phases of generating a report:



In this project, three types of cloud service will be mainly used: User authentication: A user must be able to identify themselves in a 100% secure way in the application, so that other users cannot impersonate their identity. However, it must be possible for the user to access from different places and devices and have access to all the information stored in the cloud. As authentication method, two have been selected: The use of the typical email and password and the possibility of using a previously created Google account. Databases in the cloud: It will allow saving the data of the patients and the different reports entered. The NO SQL type database, Firestore, is used (Sukmana & Rosmansyah, 2021). File storage in the cloud: Each report must attach a wide variety of documents: medical reports, invoices, etc. All this information must remain in the cloud, so that it can only be

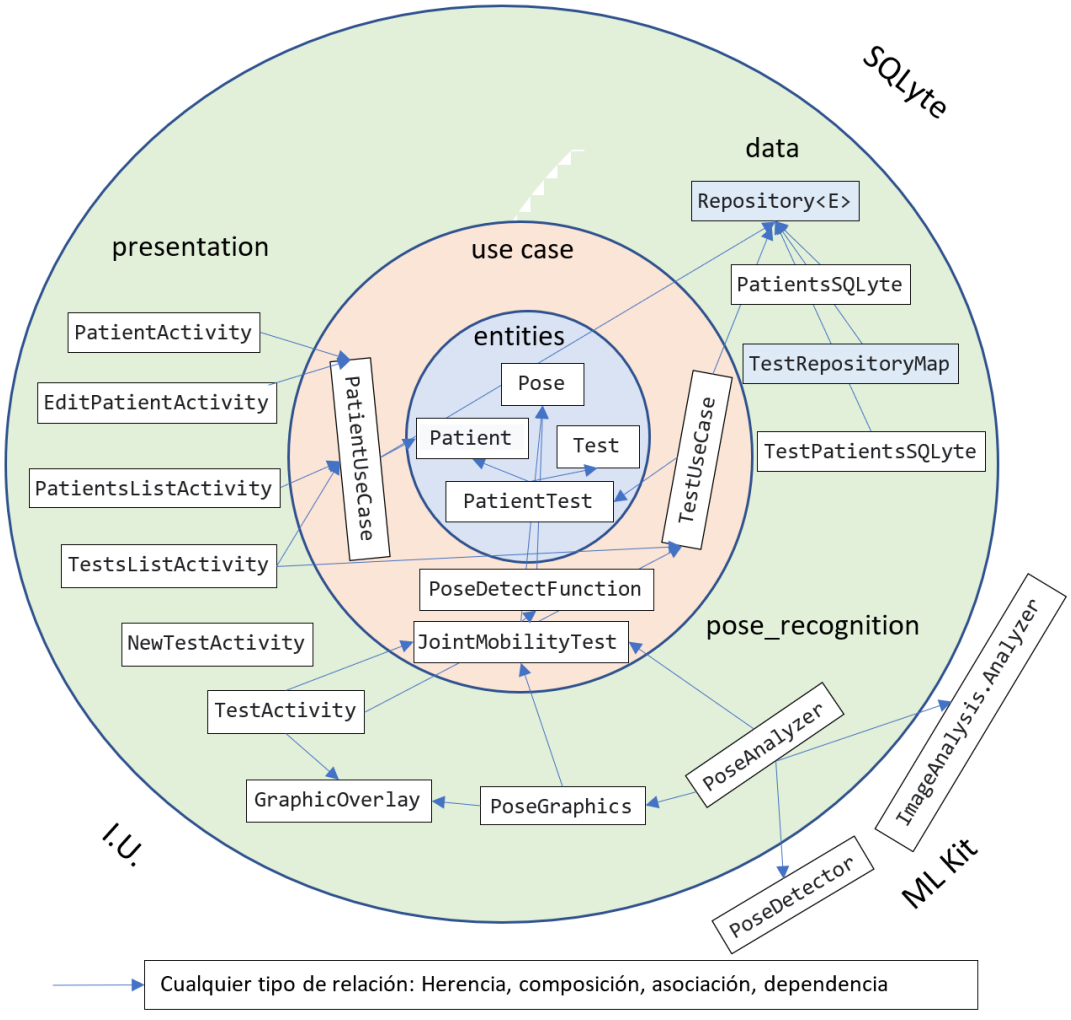
accessed by the user who created the report. This functionality is achieved thanks to Firebase cloud storage services.

It is planned that the software will be registered in the database of transferable results of the UPV. Furthermore, it is intended to publish a demo version on the Web and in mobile app stores. In a first phase, it has been planned to publish it on the Web, in a second in Google Play and in a third in the App Store. In this way, we intend to give visibility to the applications and thus be able to attract potential companies interested in their commercialization

Method

Development platform: The possibility of developing a multiplatform application was considered, which could be used from both personal computers and mobile devices and which stored the data in the cloud. This approach, which was ideal for the previous application, was not so suitable for an artificial vision application. These types of applications require the use of native programming, which must be carried out in a differentiated way in Android and iOS. It was decided to start with Android, leaving iOS development for the future. Android Studio was used as a development tool and Kotlin as a programming language (Oliveira et al., 2020).

Data storage: Continuing with the previous line, it was thought that local storage on the application user's device would be simpler and more effective. This would allow the use of the application without having access to the Internet, but it would have the drawback that the data could only be accessed from the doctor's device. Another advantage of local storage is that the application does not need user identification. We can assume that the only user who will have access to the mobile is its owner. It was decided to use SQLyte to store the databases locally, since it is the platform integrated into Android (Bhargave et al., 2013).

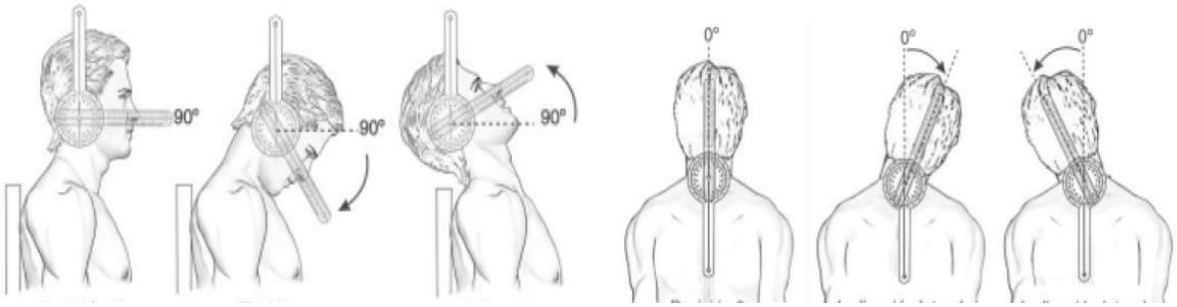


Posture detection: A posture detection software (pose detection, in English) allows you to detect a person's joints from an image. The development of Deep Learning techniques have led to the appearance of several deep neural networks that solve this problem. In this project we have evaluated some of them to try to integrate them into the system. The open source software OpenPose has given us good results[7]. But it had the drawback of being not very robust in the case of images where the person was not shown full-length. Finally, it was decided to use the free software ML Kit, as it gave much more robust results.

Software architecture: The development of the application has been guided by the use of the CLEAN architecture. The following diagram shows the relationship between the project classes and their location within the architecture. We can highlight three external layers to the development: ML Kit, for the detection of the different joints of a person from the images obtained by the camera. SQLyte, for data storage and the Android user interface system[8]. Then the outermost layers would come, such as the data layer, the presentation layer and the posture recognition layer. More internally we would have the use cases and in the center of the development, the entities.

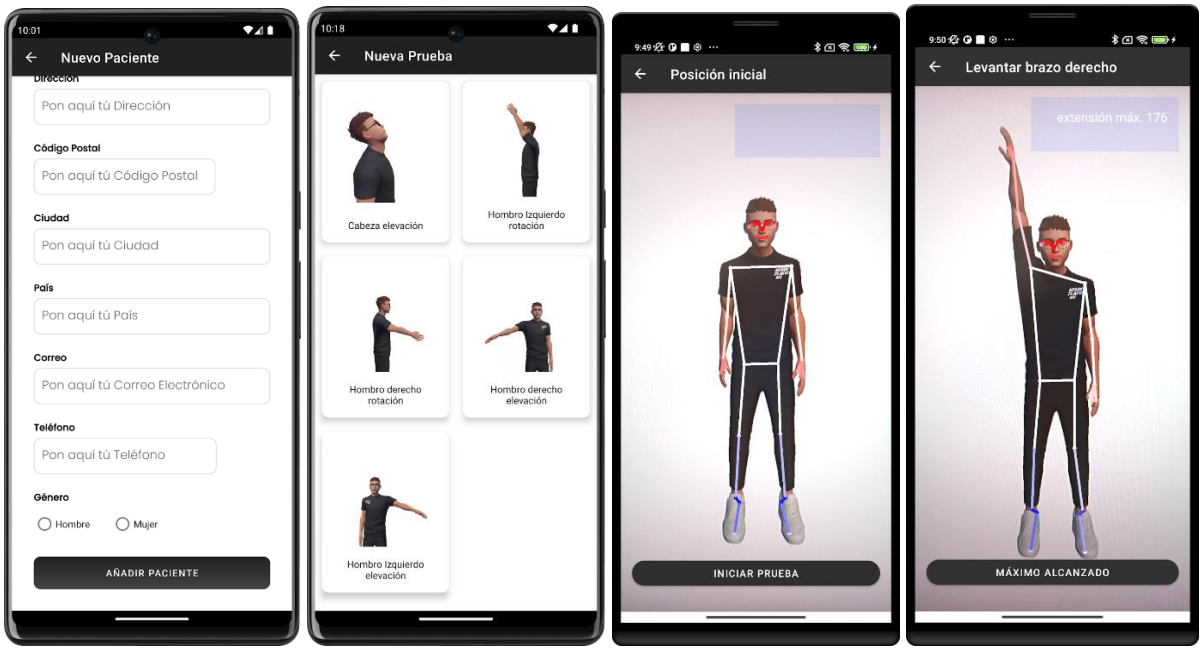
Results and Discussion

After a traffic accident, it is common for some joints, such as the neck and back, to be affected. Similar problems appear in the field of occupational accidents and handicaps. For this reason, having a fast and precise measurement system for the movement of the different joints could be of great help. Goniometry in clinical examinations is used to measure the angles that the different joints of a patient can reach.



Traditionally, the goniometer has been used to obtain these angles:

We propose a system, very easy to operate, that will allow the physician to automate the obtaining of goniometric measurements of different joints. We now describe the solution we propose. Below is a set of screenshots to illustrate this explanation. First, the practitioner installs the application on his mobile phone. This must have a front camera, and it is not necessary to be connected to the Internet. The first step will be to register the data of a new patient. This will appear in the patient list. After selecting a patient, all the tests performed will be displayed in chronological order. In this way, a record of the patient's evolution can be kept. Pressing the + button will start a new test. The doctor has to focused on the patient, so that the appropriate part of the body is displayed on the screen. Following the indications shown in an animation, the patient performs a certain movement in a joint. The app records the range of motion performed. In most cases, the maximum and minimum angle that the patient manages to reach in this joint is stored. The physician does not have to register any value, it is all done automatically by the application. You simply must hold the mobile and make sure that the patient performs the movements properly.



Conclusion

Carrying out an expert report for the assessment of bodily harm or determination of the degree of disability requires in-depth knowledge of the legislation. Thanks to the software that we present, these reports can be carried out by health personnel with little knowledge in this field. Another advantage that it offers is the saving of time in the generation of these reports. You just have to fill in the requested data, and the application is responsible for generating a report in pdf. On the other hand, a multiplatform application has been developed that will allow it to be used from a desktop computer or from a mobile device. In addition, all the information is stored in the cloud, so it is accessible from anywhere with Internet access.

Using a traditional goniometer to determine joint movement is a complex task that can only be performed by qualified personnel. A mobile application is proposed that allows automating this process, which can be used by personnel without previous experience and drastically reducing the time necessary to carry out the measurements. Another advantage is that the software runs on a mobile device using the mobile device's camera. This allows the system to be used in any location and with minimal economic cost. On the other hand, a complete patient registration system has been implemented, and the possibility of keeping a history of each one, in order to assess their evolution.

This tool will facilitate the calculation of the bodily damage of people who suffer an injury. It has several advantages over the conventional process; minimizes possible subjectivity and inter-observer variability. Significantly reduces the time required for the valuation, by not having to continually consult the legislation. It can be used by professionals with little experience in this field. The application guides the user, according to the information entered. The possibility of making mistakes is reduced, as it is carried out exhaustively. Traceability processes are improved. It is expected that the application will present great interest in insurance companies, medical expertise companies, labor mutuals, etc.

For easy diffusion, the Google Play app store will be used as a distribution channel. The exploitation model may be carried out following any of the models described below: Freemium. This type of model is one of the most successful. It is based on the duality between a free system and a premium one with higher quality services, agreements with institutions. Specific contracts are established with the mutual or insurance companies that want to use the application. These agreements may require the adaptation of the software according to the field or the specific needs of the company.

The economic impact: The payment of insurance and pensions associated with personal injury and disability in the world of work moves billions of euros annually in Spain. A tool that makes it possible to reduce errors in the assessment of these damages will have a great economic impact for both individuals and insurance companies. The Social Security Institute, through the handicap assessment teams, assigns handicap percentages that have

financial compensation determined by law. Our tool can be useful to reduce the financial cost of litigation by individuals with the administration or insurance companies. Foreseeable socio-sanitary impact our tool will mean greater transparency in the evaluation of the injured person and will allow their evaluation even remotely in the new times of telemedicine, resulting in a better quality of care for said people. In addition, the complexity of the application of the tables of the medical scales for the evaluation of bodily damage and handicaps will be reduced, facilitating the work of health personnel. Finally, it will favor a better traceability of the evaluation process that is documented in the process of measuring the angles of movement reduction. It is intended to be an easy-to-use tool that helps in a step-by-step guided process to determine and quantify the damage suffered by the patient or the percentage of disability. Applicability: Our application could also be useful in determining temporary or permanent work disabilities. In a future development of the same, its use could be useful to determine "partial", "total" or "absolute" permanent disabilities. It would be necessary to include in the assessment of bodily harm the evaluation of the ergonomic aspects of the job that the worker performs and a comprehensive assessment of this from the labor point of view. Therefore, the tool to be developed can be very useful for: - Medical-legal expert reports. - Planning or evaluation of treatments. - Control of the evolution or progress of the patient. - Determination or measurement of residual disability after a rehabilitation process. - Analysis of biomechanics before joining the job.

Scientific Ethics Declaration

The authors declare that the scientific ethical and legal responsibility of this article published in EPSTEM journal belongs to the authors.

Acknowledgements or Notes

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