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PROTOTYING MOBILE APP

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Abstract: This paper presents the prototyping and evaluation of a mobile application that is being developed to promote territorial-based innovation. It also describes the methodological procedures adopted for the application design and evaluation phases involved in its construction. To carry out a proof of concept of the prototype with a focus on usability, remote accessibility and microcopy evaluations were carried. From these evaluations, it was possible to gather several inputs enabling the improvement of the prototype interface, resulting in a more robust, reliable and feasible version of the application, thus contributing to meet the goals of the CeNTER program.

Keywords: Hypermediation, Digital Technologies, Territorial Innovation, Community-led initiatives, UserCentered Design, Mobile Application, Accessibility, Microcopy, Remote Testing.

1. INTRODUCTION

The general contribution of this paper is to present the concept of a mobile application, designed and prototyped under the scope of the CeNTER research program, to promote territorial innovation. CeNTER – Community-led Networks for Territorial Innovation – is an interdisciplinary research program running on the University of Aveiro, Portugal, since 2017, and one of its goals is to identify and develop digital tools that can best leverage the potential of the Centro region of Portugal.

The article reports the development and validation processes of the prototype of a mobile application to foster territorial innovation. The prototype simulates the functionalities of a digital hypermediation platform designed to support community-led initiatives focusing on Tourism and Health and Well-being sectors.

The article is organized as follows: section 2 introduces the theoretical background concerning user-centered design approach to the development of mobile applications adopted and also summarizes some related work; section 3 formalizes the methodological procedures adopted on the CeNTER app design and evaluation; finally, section 4 presents the main conclusions and discusses some future research paths.

Prototype

The prototyping process began with the choice of the smartphone as the target user's device. This choice led to the analysis of the challenges inherent to the development of an application for mobile devices, considering concepts such as interaction design, usability and interface design. Thereafter, the methodological procedure to be employed was conceived having a focus on a UCD approach, as aforementioned. Based on the previously defined app CeNTER requirements, previously defined directly involving different stakeholders (Renó et al, 2019),

the conceptual phase of the prototype started by drawing in paper a first set of mockups. These mockups were then used to consolidate the basic requirements and specifications of the application design. With the *Sketch* software, wireframes that outline the skeleton of the different screens were developed, such as text boxes, images and other graphic elements, which compose the interface of each screen. With these wireframes, along with the support of *Principle* software, the interaction and styles of the prototype were developed. Furthermore, also using *Principle*, it was possible to conceive a prototype with greater fidelity, deploying the style and interaction like what was intended to be obtained in the final product (Carvalho et al., 2020).

2. METHODOLOGY FOR DESIGN AND EVALUATION

The first phase of the project included the following procedures: i) systematic literature review (Silva et al. 2020); ii) mapping of innovative initiatives in the Centro region of Portugal (Tymoshchuk et al., 2019c); iii) benchmarking of social networks, applications and websites (Martínez-Rolán et al., 2019; Renó et al., 2021 ; Tymoshchuk et al., 2019a); iv) interviews with leaders of local communities and entities (Renó et al., 2018; Silva et al., 2018; Tymoshchuk et al., 2019b); v) organization of two focus groups with representatives of small and large community initiatives (Silva et al. 2019). The focus of this article is on the second phase of the project. As discussed before, a user-centered approach was adopted in the design process. Following this approach, a digital platform prototype was developed to support different usage scenarios (use cases). This phase had four main steps. I) A medium fidelity prototype was specified and developed for iPhone using the Principle software. For this prototype, a set of (78) screens were developed to simulate the specified functionalities offering navigation through elements and allowing an effective interaction. II) After achieving a stable version of the prototype, a heuristic testing was conducted with experts. This prototype intended to offer a simulated look and feel of a real mobile application, allowing the user to engage himself in a pleasant experience (Seifi, 2015). Continuous feedback from the users, in the initial stages of development of technological products, is crucial for detecting possible problems of a system. The prototype was previously evaluated by an internal team to obtain validation before moving on to the next steps. III) An accessibility assessment with an expert was remotely conducted. This process was moderated using ApowerMirror software, which allowed the expert to access the prototype, as well as the recording of the interactions. The results were transcribed and analysed using a grid, defining the levels of priority and complexity of the problems to be fixed. One of the main problems highlighted by the expert was the low contrast between graphic and text elements. Those issues were solved using contrast checker tools aligned with success criteria of WCAG 2.0. IV) Finally, microcopy methodology was used to evaluate prototype's content by an expert. This evaluation, that covered the 215 textual elements presented on the screens, was intended to identify whether the textual content used was adequate and correct, considering the context of the project, and both lexical and grammatical aspects. Furthermore, the expert was invited to provide suggestions for alternatives to the textual elements which, in his opinion, should be modified. The results obtained lead to several improvements of the final version of the prototype.

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3. INPUT AND OUTPUT DESIGN

INPUT DESIGN

The input design is the link between the information system and the user. It comprises the developing specification and procedures for data preparation and those steps are necessary to put transaction data in to a usable form for processing can be achieved by inspecting the computer to read data from a written or printed document or it can occur by having people keying the data directly into the system. The design of input focuses on controlling the amount of input required, controlling the errors, avoiding delay, avoiding extra steps and keeping the process simple. The input is designed in such a way so that it provides security and ease of use with retaining the privacy. Input Design considered the following things:

- What data should be given as input?
- How the data should be arranged or coded?
- The dialog to guide the operating personnel in providing input.
- Methods for preparing input validations and steps to follow when error occur.

OBJECTIVES

1.Input Design is the process of converting a user-oriented description of the input into a computer-based system. This design is important to avoid errors in the data input process and show the correct direction to the management for getting correct information from the computerized system.

2. It is achieved by creating user-friendly screens for the data entry to handle large volume of data. The goal of designing input is to make data entry easier and to be free from errors. The data entry screen is designed in such a way that all the data manipulates can be performed. It also provides record viewing facilities.

3.When the data is entered it will check for its validity. Data can be entered with the help of screens. Appropriate messages are provided as when needed so that the user will not be in maize of instant. Thus the objective of input design is to create an input layout that is easy to follow

OUTPUT DESIGN

A quality output is one, which meets the requirements of the end user and presents the information clearly. In any system results of processing are communicated to the users and to other system through outputs. In output design it is determined how the information is to be displaced for immediate need and also the hard copy output. It is the most important and direct source information to the user. Efficient and intelligent output design improves the system's relationship to help user decision-making.

1. Designing computer output should proceed in an organized, well thought out manner; the right output must be developed while ensuring that each output element is

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designed so that people will find the system can use easily and effectively. When analysis design computer output, they should Identify the specific output that is needed to meet the requirements.

2.Select methods for presenting information.

3.Create document, report, or other formats that contain information produced by the system.

The output form of an information system should accomplish one or more of the following objectives.

- Convey information about past activities, current status or projections of the
- Future.
- Signal important events, opportunities, problems, or warnings.
- Trigger an action.
- Confirm an action.

4. RESULT

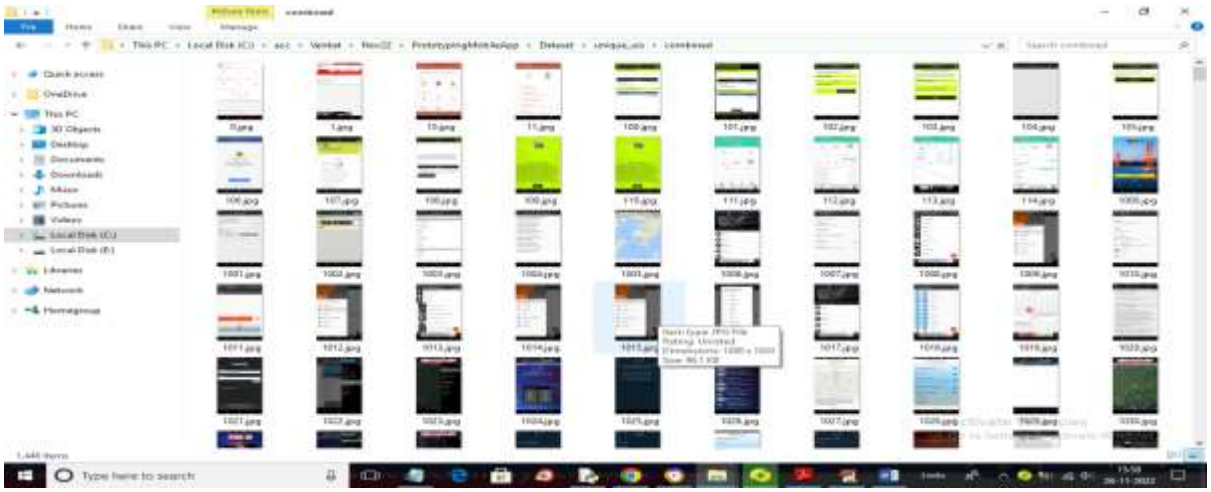
Machine Learning-Based Prototyping of Graphical User Interfaces for Mobile Apps

In propose paper author is applying CNN Neural Network algorithm to predict code for given Android GUI screen. It's common for developer to generate code for given graphical user interface but this process will take lot of experience and manual work. To overcome from above issue author is training CNN with RICO dataset which consists of CODE in JSON format and GUI images. After training we can apply this CNN model on any android screen to generate or predict code.

Predicted code will be in the form of JSON and we can use below ANDROID APP to convert that JSON code to ANDROID layout

https://github.com/flipkart-incubator/proteus

In above link we can see by giving JSON code we can get android code. In below screen I am showing images used to train CNN



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Above images are from RICO dataset which can I downloaded from KAGGLE by typing RICO dataset on Google.

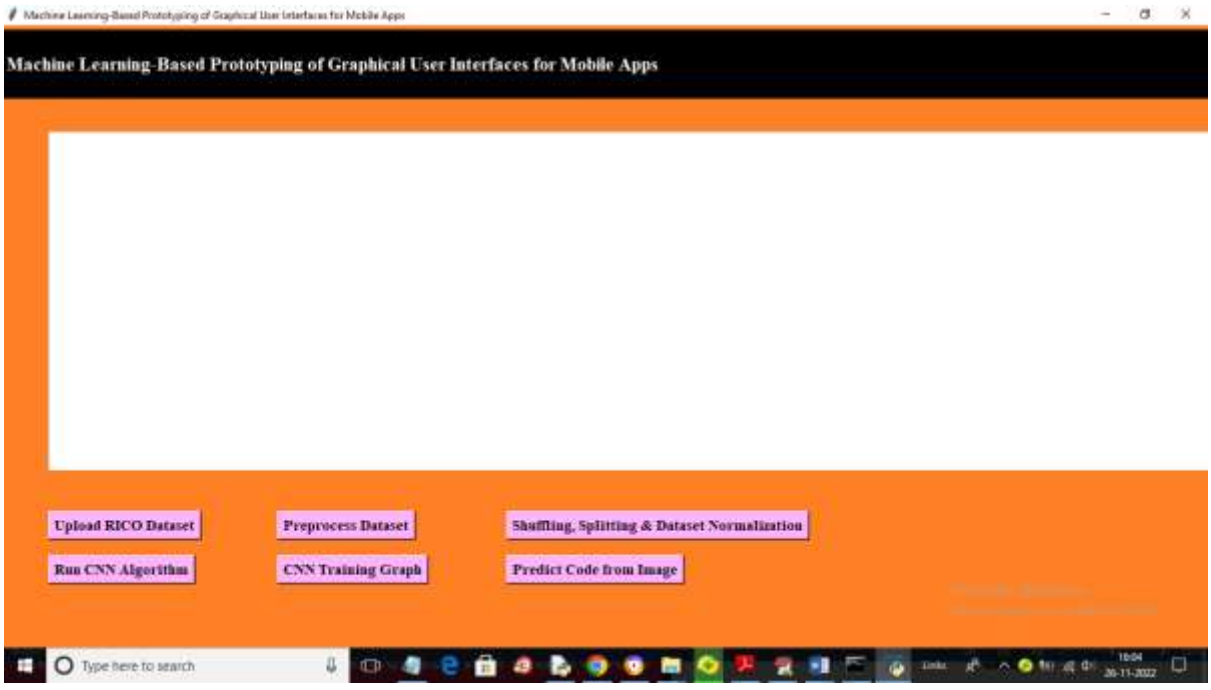
To implement this project we have designed following modules

1) Upload RICO Dataset: using this module we will upload dataset to application
2) Preprocess Dataset: using this module we will read each image and then resize and normalize all pixel values from the image
3) Shuffling, Splitting & Dataset Normalization: using this module we will shuffle dataset and then split dataset into train and test where application will used 80% dataset for training and 20% for testing
4) Run CNN Algorithm: now 80% train data will be input to train CNN and then apply 20% test data to calculate CNN prediction accuracy confusion matrix
5) CNN Training Graph: using this module we will plot CNN training accuracy and loss graph
6) Predict Code from Image: using this module we will upload test GUI screen and then CNN will predict android code in JSON format.

NOTE: in paper also author used RICO dataset and this dataset given training code in JSON format so we can get generated code also in JSON format

SCREEN SHOTS

To run project double click on 'run.bat' file to get below screen



In above screen click on 'Upload RICO Dataset' button to upload dataset and get below output

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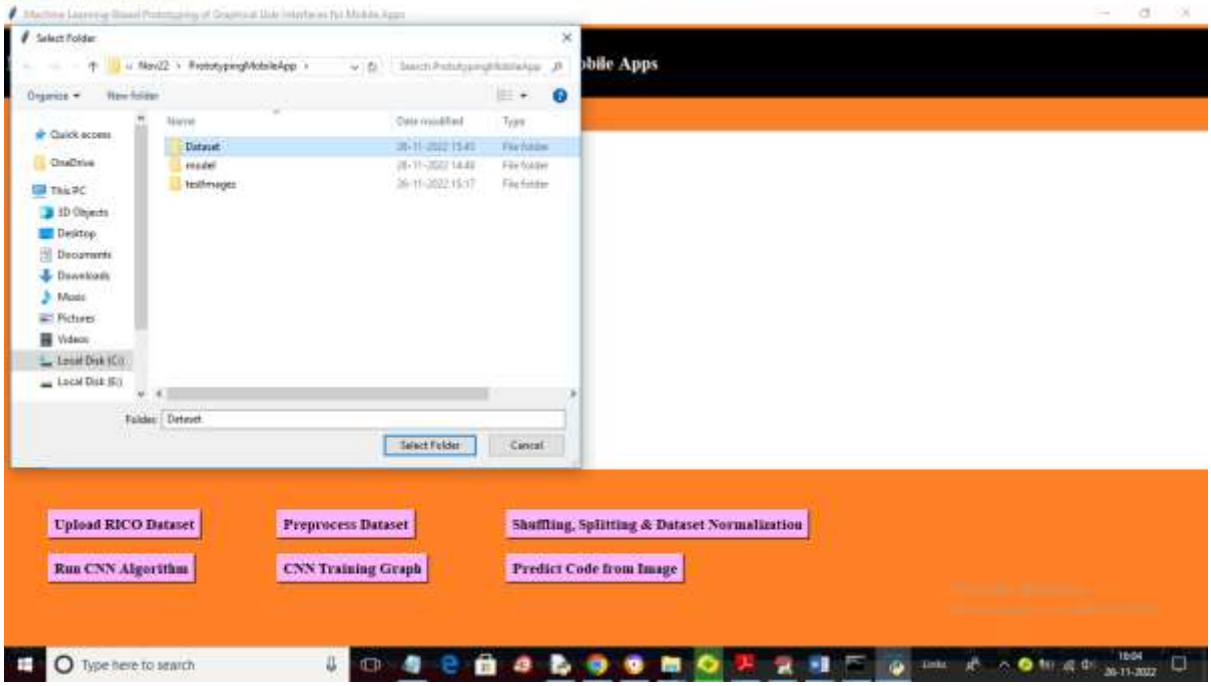
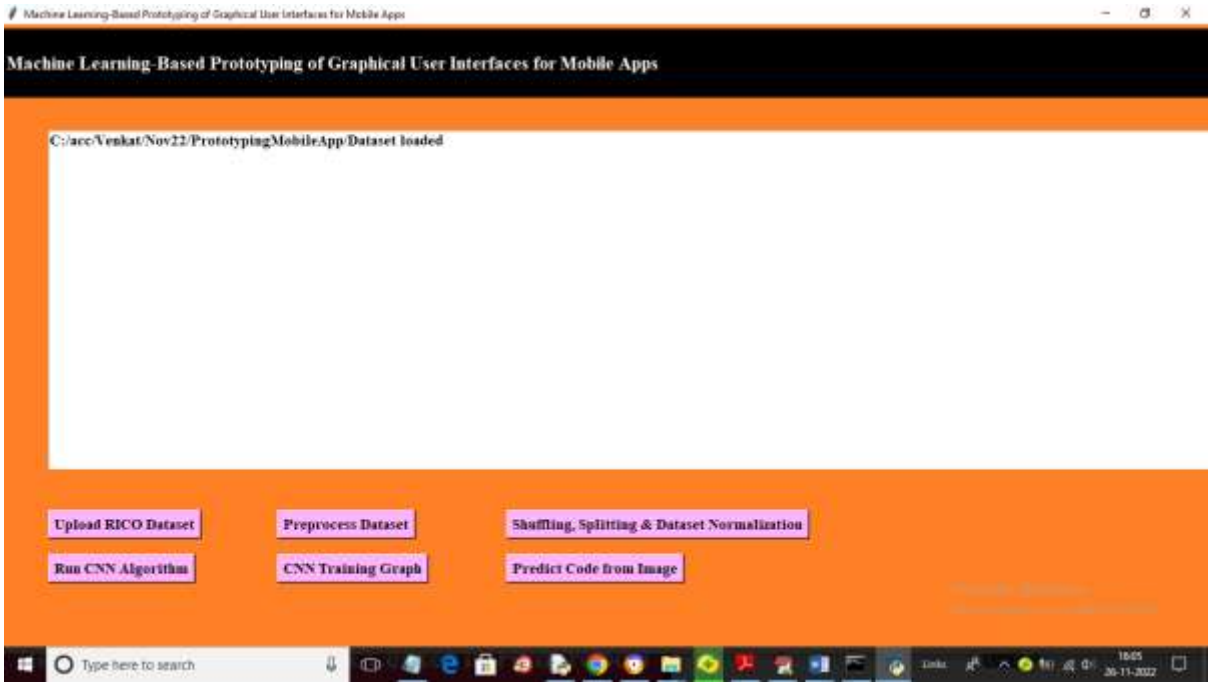


In above screen selecting and uploading 'Dataset' folder and then click on 'Select Folder' button to load dataset and get below output



In above screen click on 'Preprocess Dataset' button to read and process each image and get below output

4. CONCLUSIONS

This article reported the main aspects of the prototyping and evaluation processes of a mobile application for territorial innovation, developed under the scope of the CeNTER research program. The theoretical framework employed for designing and developing the mobile app

was an UCD approach. The prototype was developed using the *Principle* software for Mac OS and targeting the use of mobile phones. The accessibility evaluation was carried out through expert evaluation and the use of accessibility evaluation tools. Several relevant issues, regarding screen contrast, involving foreground and background colours and thickness, were identified and corrected. Regarding microcopy evaluation, it was possible to achieve results that enabled the improvement of the textual elements used in the prototype. Accessibility and microcopy evaluations with experts were adapted and conducted remotely because of the pandemic situation.

Currently, another set of evaluations is being prepared with different use cases related to the areas of Tourism and Health and Well-being. These evaluations will be conducted with a group of evaluators that represent public or private enterprises and organizations, and also individuals, with direct connection with the areas under scrutiny.

Future research plans include the design and development of the full CeNTER digital platform, and the design of the database that will support the server side of the CeNTER platform is already underway. As a limitation of this study, the prototype was only developed for iPhone interfaces, ignoring its impacts on other platforms like Android, tablets or PC. Nevertheless, this does not devalue its potentiality to be implemented in the future as a cross-platform application.

Furthermore, the number of testers that participated in the evaluation limited the generalization of the results, so further refinement of the evaluations is strongly recommended.

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