Digitalizing Personality Tests using Model-View-Controller [MVC] Framework

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ABSTRACT
The HSPQ (High School Personality Questionnaire) test originally was paper-pencil based and the process of result generation was very time consuming. Hence, with the aim of fast execution and fast report generation, we used the concept of Model-View-Controller, which is an architectural platform to digitize these personality tests. Personality is a psychological construct aimed at explaining the wide variety of human behaviors, in terms of few, steady and measurable characteristics. The following paper discusses the exploratory factor analysis and gives an overview on the statistical technique used to design simple but efficient personality tests.

General Terms
Personality tests, Model-View-Controller [MVC].

Keywords
Sten scores, raw scores, norm tables, specialized stencils, human traits.

1. INTRODUCTION
In the field of psychology, we get to see many different human behavioral traits. These traits can be found out by giving personality tests. For example, the HSPQ test is one of these tests used to find human behavior. The HSPQ is a new aid for teachers, guidance counselors and for general clinical and research use. A standardized test can be given within a class period to individuals or in a group, to yield a general assessment to a personality development. Measures distinct (14) dimensions or traits of personality, which have been founded by psychologist to come near to covering the total personality. By working with these 14 scores, the psychologist can obtain the prediction of school achievement, vocational fitness, danger of delinquency, likelihood of leadership qualities need for clinical help in neurotic condition these tests are largely aimed for children aged between 6 to 15 years. The tests consists of 144mcq-based questions based on different domains. The test is administered without a time limit but can be complete by all, but the slowest readers finish in about 40-50 minutes per form. Based on the answers given by each individual the test reports are evaluated (which is different for males and females). For evaluating the result, a statistical method called Factor Analysis is used. The answers of the mcqs are matched with the 14 factors (using specialized stencils). Place the stencil key no. 1 on the left

hand side of the answer sheet adjusting as described right to the key. All necessary instructions for applying the hand stencils to get the raw score for seven out the 14 factors are printed on the key itself. Do the same with stencil key no. 2 to get the other seven raw scores. Based on the raw score, a sten (Standard 10) score is obtained. The sten score has a range from 1-10 and it is obtained by referring to a table called a Norm table. This table helps to evaluate sten scores easily as it has numerical values that eventually get mapped to a total score from 1-10 which is also known as a sten score. The Norm table values are different based on the sex and age of an individual. For example, there are different Norm tables for Males, Females and Children. It is a universally accepted theory that a person obtaining sten score below five has given the test honestly and sten score above five has not given the test honestly. Earlier this result generation process was done manually which was observed to be extremely time and resource consuming. Hence digitalizing the test was the only solution for it. The test is digitalized using a Model-View-Controller [MVC.]Purpose behind using the Model-View-Controller [MVC] is that it divides an application into three interconnected parts. This is done to separate internal representations of information from the ways information is presented to and accepted from the user. The Model-View-Controller [MVC] design pattern decouples these major components allowing for efficient code reuse and parallel development. The Model-View-Controller [MVC] is used for desktop graphical user interfaces [GUI]. Motive behind using the Model-View-Controller [MVC] was that it has ability to provide multiple views. It has an extremely user-friendly development platform. It also provides faster development process and it supports asynchronous technique.

2. RELATED WORK
Throughout the research conducted, we came across many works related to implementation of factor analysis based algorithm and Model View Controller frameworks. In [1], Mihai Gavrilescu and NicolaeVizireanu proposed a three-layered neural network-based architecture for predicting the Sixteen Personality Factors from facial features analyzed using Facial Action Coding System. The proposed architecture is built on three layers: a base layer that extracts the facial features from each video frame using a multi-state face model. The intensity levels of 27 Action Units (AUs) are computed, an intermediary level where an AU activity map is built containing all AUs intensity levels fetched

from the base layer in a frame-by-frame manner. The top layer consisting of 16 feed-forward neural networks trained via back propagation, which analyze the patterns in the AU activity map and compute scores from one to 10, predicting each of the 16 personality traits. [2] Introduces us to a Norm-referenced error analysis useful for understanding individual differences in academic skill development and for identifying areas of skill strengths and weaknesses. It identifies connections between error categories across five language and math subtests of the Kaufman Test of Educational Achievement Third Edition (KTEA-3) through exploratory factor analyses (EFAs), whose results were supportive of models with two or three factors for each of the five subtests. The covariance patterns of some error categories across subtests, particularly within the Nonsense Word Decoding (NWD) and Spelling (SP) subtests were consistent. This analysis yields factor structures, which were used as the bases for the other articles. The first section of this paper [3] describes previous research in this domain and highlights the absence of studies comparing the effectiveness of MVC to non-MVC Web applications. The next section describes a simple Web application developed using a traditional (non-MVC) approach, Java Server Pages. We highlight the maintenance problems that exist in this application. Next, we provide an overview of MVC architectures for Web development, and describe the architecture and code of the same application developed using an MVC framework. We repeat the process using two other MVC platforms (Struts and Java Server Faces).as discussed in [3] various Limitations and Merits of the Model View Controller architecture have been observed. [4] Presents a new approach to develop the strategy of Model–View–Controller architecture pattern in Business Intelligence [BI] architecture. This paper focuses on Business Intelligence architecture model guideline for storing the heterogeneous data in one format and implements core functionality of the system. All the three independent components of the Business Intelligence Architecture are shown to be tightly coupled which ensures consistent and flexible Business Intelligence architecture. [5] Focuses on a scale developed and designed to detect invalid response patterns on the High School Personality Questionnaire (HSPQ). Using a large sample of protocols drawn from the HSPQ standardization group, ten items were found to satisfy the necessary criterion for inclusion in the resulting "random" or "validity" (RV) scale. When applied to separate cross-validation groups of nearly 2,000 valid and randomly generated response protocols, RV was found to correctly classify 79% of the profiles. In Paper [6], the author discusses and reviews the data for the High School Personality Questionnaire test. Certain parameters like factor reliabilities, construct validities and test norms have been put down for the data review. The review supplements the H.S.P.Q as a potentially valuable instrument when further research has provided sound actuarial data. [7] Explores the possible use of Internet tools in psychological research. It compares Web-based assessment techniques with traditional paper-based methods of different measures of Internet attitudes and behaviors in a sample. The collected data were analyzed to identify both differences between the two samples and in the psychometric characteristics of the questionnaires. Even if significant differences were found, Personality factor test between the two samples in the Internet attitudes and behaviors, no relevant differences were found in the psychometric properties of the different questionnaires. The results suggest that Internet-based questionnaires can be a suitable alternative to more traditional paper-based measures if sampling control and validity assessment is provided. [8] Depicts the use internet-based assessment for personnel selection. Test scores obtained via Internet should be psychometrically equivalent to those obtained by the traditional paper and pencil

test. Test results suggest that there is comparability of scores for many personality constructs. Some scales between people allowed to choose formats and those without such choice did not show much variance. Further analysis is done to find possible causes of a lack of measurement invariance in Internet and paper and pencil comparisons. In Paper [9], a web-based Examination System has been developed with JavaScript and PHP. The system provided the functions, including question management, paper generation and test online. Also the combination of client-side programming and server-side programming techniques were used and analyzed. After a detailed research on aforementioned as well as a few other works like in [10], [11], we decided to go with Factor Analysis Algorithm using MVC framework for our implementation.

3. PROPOSED SYSTEM ARCHITECTURE AND MODEL-VIEW-CONTROLLER FRAMEWORK

The architecture shows the basic workflow of the collaboration between our personality test architecture and the model-view-controller [MVC] framework.
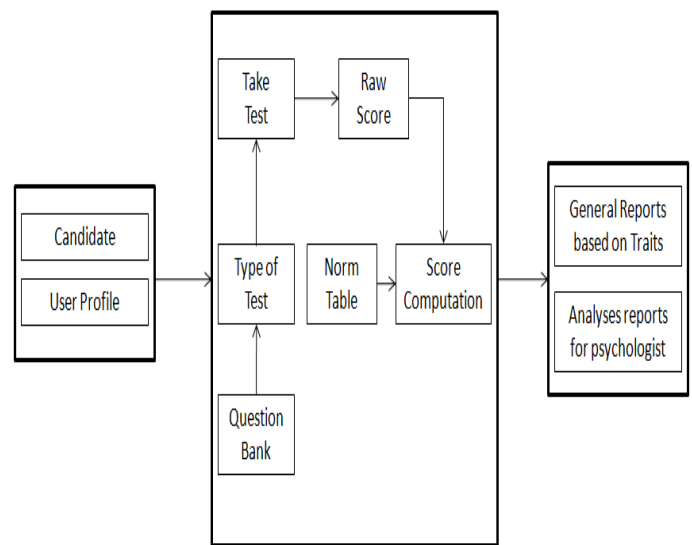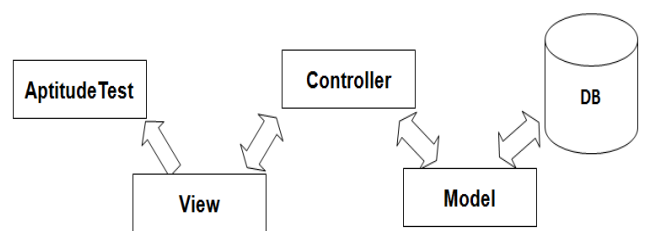

Fig 1: Architecture of Proposed System

Fig 2: MVC Based Breakdown of System

3.1 Basic Overview

1. Candidate/user profile-The candidate will do the registration process and login for the test, the user profile will consist of name, date of birth, sex.

2. Take test- once the login is successful, the candidate will be eligible to take the personality test.

3. To take the tests the question with the appropriate mcqs will be stored in a database, which is automatically available when the model-view-controller is downloaded. The answers will also be stored in this database

4. Once the candidate selects the "take-test" button the test will start.

5. Norm Table: once you take the test to compute the STEN, score a table called for which NORM table is used which has the values for computation.

6. STEN score/STEN score calculation: Based on the NORM table values the sten score is calculated.

7. After the sten score is computed the result/report is generated based on what the answers the candidate has marked.

8. The analyzed report will then go to the concerned psychologist.

3.2 Using Model-View-Controller

Based on the above architecture the user-profiles and the basic student/patient registration will be view, which is the main front end in the Model-View-Controller [MVC] .The controller, is just a remote manager, which manages the communication between the view and the model. The model space is where the Business Logic of the Personality Tests is managed. The model and the view never directly interact with each other and take help of the controller as the mediator between them.

3.3 Interaction with Database

In the php-my-admin database, which comes, as a pre-installed database with the MVC, is a user-friendly platform to store data.

3.3.1. Various tables were inserted into the database viz,

1. Patient Table

2. Question Bank Table

3. Answer Bank Table

4. Norm Values Table

5 Raw-score Table

3.3.2. Business Logic

Every table is connected to the view through the model. The controller commands which on-click button will call what table in the database. When each patient registers, his details are stored in the database. When the start test option is chosen the on-click action button of "Start Test" calls the "Question-Bank table" from the database to display the questions. Once the test is done the on-click "Save and Exit" button will be clicked and the answers will be stored in the "answer-bank" table. The answer-bank table is mapped with the "raw-score" table to get the average raw-scores for each factors. The raw scores are then mapped to the "Norm" table to get the sten scores on scale 1-10.

3.4 Factor Analysis Algorithm

In the field of psychology, we get to see many different human behavioral traits. These traits can be found out by giving personality tests. For example, the 16PF/HSPQ tests is one of these tests used to find human behavior. The tests consists of MCQ questions based on different domains. Based on the answers given by each individual the test report is evaluated (which is different for males and females). For evaluating the result, a statistical method called factor analysis is used. Factor analysis is used extensively to summarize data so that relationships and patterns can be easily interpreted and understood. It helps to isolate constructs and concepts since it is usually used to regroup variables into a limited set of clusters based on shared variance. Factor analysis uses mathematical procedures for the simplification of interrelated measures to discover patterns in a set of variables. The aim of factor analysis is parsimony, which tries to discover the simplest method of interpretation of observed data. To perform a factor analysis, there has to be univariate and multivariate normality within the data. It is also important that there is an absence of univariate and multivariate outliers. The two main factor analysis techniques are Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). EFA tries to uncover complex patterns by exploring the dataset and testing predictions, whereas CFA attempts to confirm hypotheses and uses path analysis diagrams to represent variables and factors.

3.4.1. The Exploratory Factor Analysis

The Exploratory Factor Analysis [EPA] is a statistical technique to summarize data so that relationships and patterns can be easily interpreted and understood.

3.4.2. Result Generation using EPA

Candidate will submit the test and the answers of the test will be stored in a php-my-admin database. After the answers are stored at the backend, each mcq selected by the candidate will be mapped to a raw score for all of the 14 factors. Each of the fourteen factors have 8 questions related to it. The raw score for each of the fourteen factors will be added and an average raw score for each factor is formed. (The raw score has values between 0-2 for each multiple-choice question).

3.4.3. Concept of NORM TABLE

After the raw score is generated for each of the fourteen factors a STEN (Standard Ten) score has to be generated .For this a NORM table is needed which has values of raw scores by which the values can be mapped to Sten scores ranging from 1-10. This table helps to evaluate STEN scores easily as it has numerical values that eventually get mapped to a total score from 1-10 which is also known as a STEN score. The Norm table values are different based on the sex and age of an individual. For example, there are different Norm tables for Males, Females and Children. It is a universally accepted theory that a person obtaining STEN score below five has given the test honestly and STEN score above five has not given the test honestly.

3.4.4 Result Generation

Once the sten scores for all the fourteen factors are obtained, they are converted into a graphical format on an A4 size paper. The sten scores of each factors are matches with pencil to form a graph.

3.4.5 Psychological Assessment

The obtained result along with the graph is then given to the psychologist for further evaluation and to find the personality traits of the individual

3.5 Workflow

Fig. 3 shows the overall workflow through a dataflow diagram
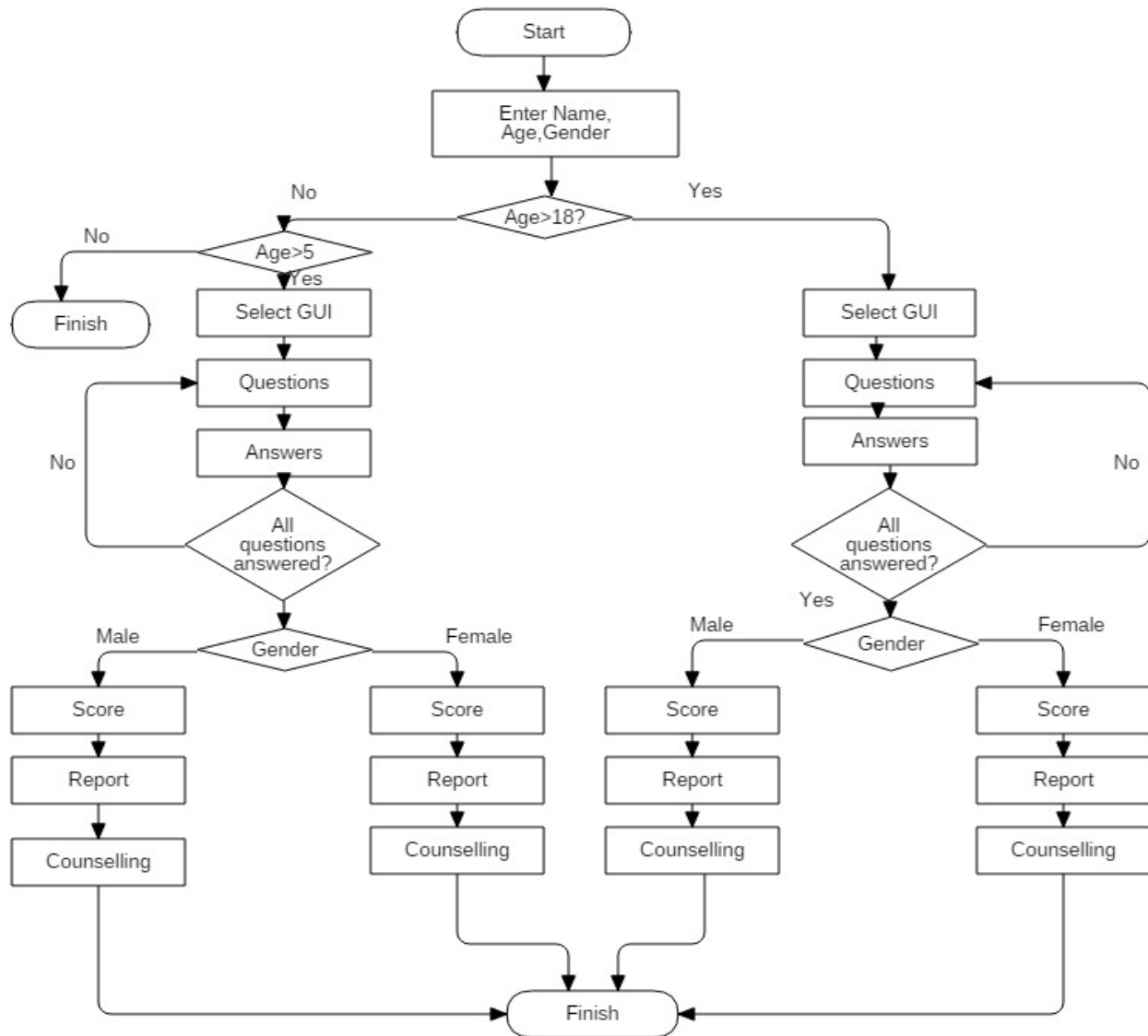

Fig 3: System Workflow via Flow-Chart Diagram

4. CONCLUSION

Hence, the HSPQ test were digitalized successfully using Model-View-Controller to predict human traits. There is a huge future scope for psychology tests for personality prediction using Factor Analysis. New features can be added to the questionnaire to predict candidate's personality better than the current psychology tests. Given sufficient research and development funds, psychology tests can become a powerful tool for personality prediction. It can definitely change the way an individual sees his/her life. However, the limited availability of funds in a capital-short environment could restrict the growth of this technology. However, given the proper encouragement and impetus, the Personality prediction algorithm can provide many benefits. Apart from this, the MVC platform proved a success for implementing the tests. More factors can be added to the personality tests to increase precision and accuracy as MVC is a flexible platform. New features can be added to the questionnaire to predict candidate's personality better than the current

psychology tests. Various such test can be developed on MVC platform to increase accessibility. Plagiarism detector can be used to detect malpractices. Further research aided by development funds can help psychology tests can become a powerful tool for personality prediction. Counseling can be improved in order to help change the way of life of a person.

5. ACKNOWLEDGMENTS

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