EMPIRICAL TESTING

For

Project no. 7

Classroom Visualization App1

Group no. 16

Ansh Sood - 160101012

Kanika Agarwal - 160101038

Shimona Verma - 160101065

Table of Contents

Empirical Testing

1. Introduction:

Empirical study is the collection and analysis of end user data for determining the usability of an interactive system by an observation-based investigation. It is based on three themes:

• Raising and Answering Questions (Testable research questions)
• Observation and Measurement of variables
• User studies

2. User Profiles:

1. **Teacher:**
    - Teacher uses this app to determine mental states of students present in class.
2. **Student:**
    - Mental states of students are determined in real time camera view.
    - Student ID along with his/her name and picture are stored.

3. Testable Research Questions:

Testable Research questions help in testing the usability of the system. It can also help in comparing the performance like speed, learnability of a system with respect to an existing system.

3.1 Research Questions:

1. Considering correct orientation (front faced) of faces what is the range upto which our app is detecting faces?

Factors	Levels
Camera quality of android device.	5 MP, 12 MP

2. If distance from camera is varied taking 10 students in camera frame, what is the accuracy ratio of faces (front faced) detected by the app? Here accuracy ratio = (number of faces detected/ total faces present)

Factors	Levels
Maximum Distance of Faces from the camera	0-2, 2-5 (in metres)
Camera quality of android device.	5 MP, 12 MP

3. What is the amount of time taken by the user to complete a task? Task types are defined as:
    1. Add a new student
    2. Update existing details
    3. Delete existing student details

Factor	Level
Task Type	1, 2, 3
User Expertise	Novice, Expert

3.2 Dependent Variables-

1. Detection Range (m)
2. Detection Accuracy Ratio
3. Task Completion Time (sec)

3.3 Independent Variables-

No.	Independent variable	Test Conditions
1	Camera quality of android device.	5 MP, 12 MP
2	Maximum Distance of Faces from the camera	0-2, 2-5 (in metres)
3	User Expertise	Novice, Expert
4	Task Type	1, 2, 3

3.4 Validity of Research Questions:

The research questions formulated are internally valid (more focus on test conditions)

Question 1: The given Independent variables can compute a reasonably accurate value for the measure of Detection Range.

Question 2: The given Independent variables can compute a reasonably accurate value for the measure of Detection Accuracy ratio.

Question 3: The given Independent variables can compute a reasonably accurate value for the measure of task completion time.

Since the questions are narrow testable research questions, the outcomes influencing the broader questions are also covered.

4. Experiment Design:

Experiment design in the context of empirical research refers to the organization of variables, procedures, participants, etc. in an experiment.

4.1 Experiment Objectives:

The experiment is designed in order to pre-decide on the number and category of participants to be involved, the apparatus to be used and the procedure to be followed for collecting data and categorization of variables.

4.2 Participants:

Ten participants were employed for empirical study.

4.3 Procedure For Collecting The Data:

1. The participants were first explained the general objective of the Experiment.
2. Then the app control was handed over to the participants.
3. The participants were allowed to explore the app for a while for familiarization
4. The collection of data was initiated after this.
5. Each participant was allowed to search the query 1 time.
6. Each participant was allowed to navigate through all the models.
7. In total 4 observations were collected for the first question.
8. In total 8 observations were collected for the second question.
9. In total 6 observations were collected for the third question.

4.4 Control Variables-

Control variables are Factors that might influence a dependent variable, but are not under investigation need to be accommodated in some manner

1. Room lighting conditions
2. Screen Resolution
3. Face Orientation

4.5 Design Specifications:

The design specifications for the three dependent variables are as follows:

1. Detection Range:

A (2) between subjects design has been employed. This means that we have 1 independent variable with 2 levels, and each participant has been tested on only one level of independent variable (between subjects design)

2. Detection Accuracy Ratio:

A (2x2) between subjects design has been employed. This means that we have 2 independent variables with 2 levels for the first and 2 for the second, and each participant has been tested on only one level of each independent variable (between subjects design).

3. Task Completion Time:

A (3x2) between subjects design has been employed. This means that we have 2 independent variables with 3 levels for the first and 2 for the second, and each participant has been tested on only one level of each independent variable (between subjects design).

4.6 Data Tables:

1. For Detection Range:

Participant No.	Camera quality of android device.	Detection Range(in meter)
1	5MP	2.2m
2	5MP	2.5m
3	12MP	3.6m
4	12MP	3.7m

(MP=Mega Pixel)

2. For Detection Accuracy Rate:
(we have used total 10 people in a frame)

Experiment No.	Camera quality of android device.	Distance Of Faces from camera	Detection Accuracy Ratio
1	5MP	0m-2m	0.9
2	5MP	2m-5m	0.2
3	12MP	0m-2m	1.0
4	12MP	2m-5m	0.6
5	5MP	0m-2m	1.0
6	5MP	2m-5m	0.1
7	12MP	0m-2m	1.0
8	12MP	2m-5m	0.5

3. For Task Completion Time:

Participant No.	Task Type	User Expertise	Task Completion Time(in seconds)
1.	1	Novice	34
2.	1	Expert	19
3.	2	Novice	43
4.	2	Expert	22
5.	3	Novice	27
6.	3	Expert	12

5. Result:

For Detection Range:

- Sample Standard Deviation(s): 0.76157
- Variance (Sample Standard)(s*s): 0.58
- Total Numbers (N): 4
- Sum: 12
- Mean (Average): 3

For Detection Accuracy Ratio:

1. For 0-2m
    - Sample Standard Deviation(s): 0.05
    - Variance (Sample Standard)(s*s): 0.0025
    - Total Numbers (N): 4
    - Sum: 3.9
    - Mean (Average): 0.975

2. For 2m-5m
    - Sample Standard Deviation(s):0.23804
    - Variance (Sample Standard)(s*s): 0.566
    - Total Numbers (N): 4
    - Sum: 1.4
    - Mean (Average): 0.35

For Task Completion Time:

- Sample Standard Deviation(s): 11.0890
- Variance (Sample Standard)(s*s): 122.96
- Total Numbers (N): 6
- Sum : 157
- Mean (Average): 26.16