CS243

Group 11

Project 6

Fruit/Vegetable Nutrition Visualizer

Empirical Testing Document

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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.

The conduction of empirical study for the Fruit/Vegetable Nutrition Visualizer App system is based on these three themes.

2. Brief Description

App : Fruit/Vegetable Nutrition Visualizer.

Description : This app will provide users a service to get nutritional and health hazard information of fruit/vegetables directly by viewing them thought their device camera. Information will be shown in augmented form

We are conducting an empirical study for our app Fruit/Vegetable Nutrition Visualizer. We wish to determine whether our app is better than the existing apps namely YOLO app and FoodUI in improving the system by making it faster and more easy to use for the general uses.

2.1 Representative Tasks

1) Ask the participant to get Nutritional And Health Hazards information for given fruits.

2.2 Participants

We shall use 20 participants for our empirical study (Between Subjects i.e. tested on only one level of each independent variable)

USER PROFILE

- Able to use android devices
- Able to understand English
- Older than 14 years

2.3 Testable Research Questions

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. The existing system used for comparison with our system is a similar Fruit Nutrition Visualizer.

• *Research Questions:*

Q1. For a given set of device and camera orientation wrt object what is the TimeTaken to show output on screen to user when error rate is kept under 2%?

Independent Variables: CameraQuality(MP), CameraOrientation(Degree).

Control Variables: Background_Colour, Light_Intensity.

Dependent Variable: VisualisationTime(s).

FACTORS	LEVELS
CameraQuality	5MP, 8MP,16MP
CameraOrientation	0^0 , 30^0, 90^0

Q2. For specific set of device and camera orientation wrt object what is ErrorRate (In %)?

Independent Variables: CameraQuality(MP), CameraOrientation(Degree).

Control Variables: Background_Colour, Light_Intensity.

Dependent Variable: ErrorRate(%).

FACTORS	LEVELS
CameraQuality	5MP, 8MP,16MP
CameraOrientation	0^0 , 30^0, 90^0

- **Validity of Research Questions:**

The research questions formulated are Internally Valid.

Q1. The first question determines whether our app is faster than the existing app that can be used for the same purpose i.e. FoodUI by noting the time taken by the user to do a representative task and using statistics to prove our system faster.

Q2. The second question determines the efficiency of our system by comparing the error rate of our app with FoodUI app and uses statistics to prove our app more efficient and easy to use.

*S*ince the questions are narrow testable research questions, the
outcomes influencing the broader questions are also covered.

2 . Experiment Design

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

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.

Participants:

Twenty participants are asked for empirical study.

S.N.	Age	Gender	Background	Android Experience	Programming Experience

1	18	M	S	1	3
2	20	F	S	3	2
3	19	F	S	2	3
4	18	M	S	2	2
5	17	M	NS	1	1
6	18	F	S	1	2
7	17	M	NS	3	3
8	16	M	S	3	2
9	21	M	NS	2	1
10	22	F	NS	3	2
11	18	F	S	1	2
12	19	M	S	2	3
13	20	F	NS	3	2
14	20	M	S	2	1
15	21	F	S	2	1
16	23	M	S	3	3
17	22	M	S	1	2
18	22	F	NS	2	3
19	18	M	S	1	2

20	17	M	NS	3	3

BACKGROUND:

Student – S,

Non Student – NS

ANDROID EXPERIENCE :

BASIC-1,
INTERMEDIATE-2,
ADVANCED-3

PROGRAMMING EXPERIENCE :

BASIC-1,
INTERMEDIATE-2,
ADVANCED-3

Procedure For Collecting The Data:

- The participants were first explained the general objective of the Experiment.
- Then the app was launched and the control handed over to the participants.
- The participants were shown “How to search a query” interactive tutorial.
- The participants were shown “How to navigate” interactive tutorial
- The participants were allowed to explore the app for a while for familiarization
- The collection of data was initiated after this.
- Each participant was allowed to search the query 1 times.
- Each participant was allowed to navigate through all the models.
- In total 10 observations were collected for the first question.
- In total 10 observations were collected for the second question.

Control Variables:

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

For this app following are control variables:

- Light intensity
- Background colour

Independent and Dependent Variables:

The independent variable CameraOrientation of device is encoded as:

O Degree = 0

30 Degree = 30

90 Degree = 90

The independent variable CameraQuality of device is encoded as:

5MP = 5

8MP = 8

16MP =16

Dependent Variable	Factors	Levels

VisualizationTime	CameraQuality(in MP)	5,8,16
	CameraOrientation (in Degree)	0,30,90
ErrorRate	CameraQuality(in MP)	5,8,16
	CameraOrientation (in Degree)	0,30,90

Design Specifications:

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

Between subjects design is choosen.

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

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

variable (between subjects design).

Observation Tables:

For VisualizationTime:

Participant	CameraQuality (MP)	CameraOrientation (Degree)	Visualization Time (s)

1	5	0	1
2	16	30	3
3	8	90	2
4	5	0	1
5	16	90	3
6	8	30	4
7	8	0	2
8	16	90	1
9	5	0	2
10	5	30	1
11	16	0	3
12	8	90	4
13	5	30	2
14	16	0	1
15	8	90	2
16	5	0	3
17	16	30	1
18	8	90	2
19	8	0	2

20	16	30	1

Data Table:

Participant	Our App (in Sec)	FoodUI (In Sec)
1	1	2
2	3	4
3	2	1
4	1	2
5	3	3
6	4	2
7	2	4
8	1	2
9	2	3
10	1	2
11	3	3
12	4	4
13	2	3
14	1	3
15	2	2
16	3	4
17	1	2

18	2	3
19	2	2
20	1	3

We shall use one-way ANOVA technique to determine whether there are any statistically significant differences between the means of our method and FoodUI's method.

Anova Table:

	Our App	FoodUI
Mean	2.05	2.7
SD	0.99	0.86
Variance	0.99	0.74

For ErrorRate:

In result

*1 for correct output
0 for incorrect output

Observation Table:

Participant	CameraQuality (MP)	CameraOrientation (Degree)	Results
1	5	0	1
2	16	30	0
3	8	90	1
4	5	0	1
5	16	90	1
6	8	30	1
7	8	0	1
8	16	90	1
9	5	0	0
10	5	30	1
11	16	0	1
12	8	90	1
13	5	30	1

14	16	0	1
15	8	90	0
16	5	0	1
17	16	30	1
18	8	90	1
19	8	0	0
20	16	30	1

Data Table:

Participant	Our App	FoodUI
1	1	1
2	0	0
3	1	0
4	1	1
5	1	0
6	1	1
7	1	0
8	1	0
9	0	1
10	1	0
11	1	1
12	1	0
13	1	0
14	1	0
15	0	1

16	1	0
17	1	1
18	1	1
19	0	1
20	1	1

	Our App	FoodUI
Error Rate (%)	20	50

5. Broader Questions and Results

- Do you think that our app is more efficient for Fruit/Vegetable Nutrition Visualization than FoodUI?

  Comments: 15 out of 20 users preferred our app over FoodUI.

- Which feature of our app do you think is most useful?

  Comments: 12 Users preferred RealTime visualisation.
  8 Users preferred Health Hazards information.

- Which app do you prefer overall ?

  Comment:18 out of 20 preferred our app.

6. Result

- Using the analysis from question 1 we can say that our system is faster wrt the FoodUI App.
- Using the analysis from question 2 we can say that our system is more efficient and user friendly wrt the FoodUI App.

7. Conclusion

We conclude that our Fruit/Vegetable Nutrition Visualizer app is better than the existing FoodUI app as shown by the empirical study.