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Integrating revised Bloom Taxonomy in Multimedia and HCI with a case study of Food Dishes

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Abstract: Teaching multimedia and human computer interaction is an interesting task to the students in sultanate of Oman who are having innovative skills in multimedia design using tools. Designing a multimedia project with all advanced graphics techniques is a highly complex and complicated procedure in class room. Teaching activities are aligned to the improved bloom taxonomy to achieve self learning and critical thinking in students. The practice has been developed through practical implementations and considered as Project Based Learning (PBL). Students have developed the project starting from scratch, proceeding to the design and then implementation. A gradual approach allows students to recognize by the design the different concepts of graphics and human computer interaction(HCI) techniques that were introduced during the lectures. All the practical and tutorials are based on the instinctive realization of graphics techniques and then integrating to make the final project. The results were high positive and each student have made their own creativity. The levels of project has been covered all phases of improved bloom taxonomy in order to attain quality teaching and learning. An outline for multimedia and human interaction course and integration of revised bloom taxonomy is presented in this paper.

Keywords*: revised bloom taxonomy, Project Based Learning(PBL),multimedia, graphics, Human Computer Interaction(HCI)*

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I. Introduction and Background

To classify educational objectives, Benjamin Bloom with collaborators in 1956, defined a educational model which was known as blooms taxonomy. Through this multi-tiered model thinking can be categorized as per six cognitive levels of complexity[1]. The model contains six main criterions such as knowledge, comprehension application, analysis, synthesis and evaluation. In the original version of the framework, all groups except knowledge was recognized as skill and abilities and knowledge was considered as the prerequisite for the practical implementations of skills and abilities. This framework is a hierarchical framework to categorize thinking in order to motivate the students to climb to a higher thought by the lecturers. In this multi layered model, each level is included by the higher levels. The need of bloom taxonomy is high because of the following reasons.

- It is important to create learning goals in a pedagogy since teachers and leaners get similar understanding
- Teachers can use frameworks to arrange objectives and hence can clarify goals to students.
- Arranging goals helps
    - to plan and deliver suitable instruction
    - to design proper assessments
    - to make sure that assessments and instructions are associated with the goals.

A revised version of this taxonomy was released in 2001 which focuses dynamic conception of classification rather than the static view of educational objectives. The revised bloom taxonomy raised from the basic question " where do we begin in seeking to improve human thinking?"(Houghton, 2004)..In revised version, changes of terms happened which is more suitable for 21st century. All basic categories are converted from noun to verbal forms. The lowest level of the initial version-knowledge- has become remembering. The final levels such as comprehension and synthesis are renamed as understanding and creating[1].

Revised Bloom Taxonomy

As per the revised version, categories are remember, understand, apply, analyze, evaluate and create.

Recollecting previously learned material, terms, concepts etc..and expressing next topic in terms of the previous one is the action verb intended in the category remember. The tasks include recognizing, listing explaining, retrieving, naming and finding. When the learner do the processing of tasks such as choose, define, describe, give example, group, know, locate etc..,the remember category will be fulfilled. In assessment, he can write definition, write facts, put label, attend quiz as result of remember. workbook, worksheet, test etc. can be done through the reproduction due to remember. Leaner can try to recollect the answer for queries like what happened later..? How many..? what is..? who..? can you name..? which is true or false..?

The definition of understanding points to explain ideas or concepts. To explain the idea, interpreting should be done first and followed by making summary, and paraphrasing to be done. The classification can be done before explaining the idea in detail.

The verbs such as classify, compare, contrast, explain, illustrate, infer ,interpret, outline, relate, show, translate etc.To understand the assessments, questions like" can you write in your own words, what could happen next..,what was the main idea etc. can be passed to get the answers . To understand the idea in assessments, we use the queries such as definition, explanation, example, summary to get results.

The next level of taxonomy is applying the idea or information in another situation. This implementation can be expressed through the words such as practice, produce, solve, show, apply, demonstrate, illustrate etc. The taxonomy of applying can be brought out in assessments when we get answers for the words demonstration, experiment, model, lesson etc. The queries can be of type "do you know another instance where..?, can you group, can you develop a set of instructions about…?".

The analyzing level breaks the information to parts and understands the relationships. This can be done using comparing, organizing, breaking the existing information and exploring the facts. Analyzing is possible with the help of entities such as chart, database, checklist, outline, questionnaire, report, summary etc. in assessments. The words include calculate, categorize, contrast, examine. Discover, examine, question, sequence, solve, survey etc. The queries should consists of " how is ..similar to..?, why did..occur?, what are some other outcomes?,what was the problem with..?.

Evaluation level will be followed after analyzing level. In this level a decision or an action is justified through the process checking, experimenting and hypothesizing. The session entitled like conclusion, report, survey, recommendation etc.. will define evaluation level. This session can be developed through the questions " is there a better solution to..?, how would you feel if..?, what are the prons and cons of..?, how effective are..? etc. The verbs of this session consists of choose, compare, conclude, debate, decide, justify, recommend tell why etc,

All elements are combined in a new method and compiled the information in a different way in the creation level which is the final level of taxonomy. In this level an alternative solution can be proposed or new ideas can be generated,new invention or design can be made. The concepts like blueprint, formula, invention, story board etc. provides the creation level in assessments. The enquiries can be "how would you device your own way..?, how many ways can you..?, can you see a possible solution to..?, can you design a..?, what would happen if..?" etc.. The verbs which can constitute the creation level comprised arrange, compose, design, device, formulate, construct etc..

Multimedia and Human computer interaction (HCI) is a vital domain for computer experts and software specialists. The approaches to integrate revised bloom taxonomy with the curriculum of Multimedia and HCI to bridge the gap between the CS specialists and CS educators are presented in this paper. Here various implementations of multimedia and HCI which are there in curriculum and how they are targeting CS educators are discussed. These implementations include module outlines, reference books, tutorial and practical which lead to project ideas. Paper explores how each outline integrates revised bloom taxonomy to recognize Deepness of knowledge to be masters by learners.

In the current approach of multimedia and HCI, psychological guidelines which should be followed in the design of a user interface, technical details in the design, testing details to be covered for evaluation etc. are discussed. The paper points out how the structure of multimedia and HCI curriculum supports computer science (CS) educators to teach a consistent design, evaluation and implementation of both software technology and user interface.

The remainder of this paper is as follows: in the next section we will cover recent approaches to multimedia and HCI courses in CS in section II, all aspects of multimedia and HCI teaching using the project based output; this includes educational as well as technical aspects. In section III, the effectiveness of our approach is discussed before the conclusion and the future directions in section IV.

II. Recent Approaches to multimedia and HCI Courses in CS

In the curriculum of multimedia and HCI, there are eight units which covers the interface design factors, technical details and testing factors. The units are

2.1 state of the art

Various approaches to integrate multimedia and HCI to bloom taxonomy has been reported. A studio based approach [3] is described in teaching user interface (UI) design. This contains weekly design problems and interaction with students and faculty. This approach provides more focus on realistic design process than the guidelines of design. Another survey points that vital factors for software quality are design of user interface and user friendliness[5].

III. Case study

3.1 Educational aspects

Multimedia and HCI is a Project Based Paradigm(PBL) and learning outcomes are prepared along with practical tasks with vital role of learner as individual group in the design of the product. PBL is used to motivate multimedia and HCI learning and hence in the design of a multimedia project. The author is having long term expertise in the course in different academic programmes. The main structure of the course is the flexibility to suit in all academic environments regardless of their level and resource constraints.

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In addition to the learning of the various usage of media, tools and theory behind, learner also develops a multimedia project passing through all levels of revised Blooms taxonomy in the process of making product from abstract to concrete. The approach of PBL is used in the arrangement of activities so that learning is started from the beginning to make story boards that will be later used in the design of the project. In each session students are self directed which enhances the critical thinking capacity and further suggested exercises for more practice. They are instructed to discuss in similar groups and then work individually. At the end of the semester a real time multimedia project is generated from each students with a report in detail.

3.2 Learning environment

Multimedia and HCI is a course for fifth semester computer science students and has a prerequisite of computer architecture and Java language. This module has theoretical part and practical part. Substantial practical part includes tutorials and practical sessions. The use of specialized tools for user interface, audio editing software, image processing software, animation software and multimedia authoring software are included in practical sessions.

A previous knowledge of computer organization and architecture , java knowledge are required for doing this module. Main objective of the module considers human computer interaction(HCI) through the development of proper user interfaces. Use of mutiledia such as graphics, text, sound, animation, interaction etc. are discussed in the module content. Technical details of multimedia and their use in computers and significant practical aspects by processing of audio and image files, development of multimedia applications using interface development tools are discussed in this module.

Students are provided the software such as HTML5,Javascript and CSS to design the project. In the computer lab high speed internet connection is available . There is one case based assignment should be submitted by students in the course work in addition to the final examination. Assignment carries 50% marks and for each student individual output should be submitted.

3.3 course structure

The objectives of the module consists of

- Human computer Interaction concepts and cognitive psychology issues in HCI.
- Requirement of user interface for real time systems.
- Design of user interface with a proper emphasis on the visual aspects of presentation and interaction.
- User testing of an interface.
- Knowledge on standards for representing audio files in computers.
- Knowledge on standards and issues during the implementation of static/dynamic visual input/output on computers
- Practical experience in multimedia design and implementation.

The module is a gradual design of a multimedia project. Required software's are installed in all computers in lab. The module consists of following topics[6].

User Interface

- Motivations for human factors in design: safety-critical systems, industrial and commercial uses, office, home, and entertainment applications.
- The place of human factors, usability and interface design in the software life cycle.
- Adjusting the computing environment to the user (accommodation of human diversity): cognition, perception and physiology.
- Mechanisms of interaction with machines (I/O devices [mouse, keyboard, displays, ...], interaction styles [command line, menus, GUIs, VR]).
- Usability, completeness, consistency: the design of the user interface
- Evaluating the user interface.
- Usability testing
- Use of interface design tools

Graphics

- Colour and the production of colour on graphical output devices
- Graphical representation and techniques
- File formats of static and dynamic images: standards, uses, data compression, quality
- Principles of animation: model design, animation design, production Sound
- Auditory input and output: standards and techniques

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- Quality of service and usability in sound Multimedia authoring
- Project design: setting up, requirements, navigation, storage, delivery
- Authoring tools: history, comparison of different approaches, functionality and principles
- Web-based authoring
- Applications (eg. kiosks, distance learning, web-based)

IV. Design principles

Students are required to do individual project for the assignment. The title of the project should be of real time nature. Various phases of projects should be recorded in the report and should be submitted along with the project submission. Report consists of the following contents.

- introduction
- design aspects
  - story boards
  - navigational maps
  - hierarchical task analysis diagram|
  - prototype
- usability testing
  - test plan1
  - test plan2
  - application usability tests
- references.

In this paper the case study of dishes around the world is described.Food dishes evolved greatly with the progress of the ages, where human try since a presence of innovation and invention, and add whatever they wants to be able to survive, but a delicious way. Many foods in the world, there are thousands of different varieties to suit all tastes whatever; it is hot to the sweet, passing through the sour, salty and other sub-flavors, where many countries offer according to personal standards that each has a very special cuisine which has become famous around the world. George Bernard Shaw say "There is no sincerer love than the love of food", by looking at the number of amazing dishes around the world this argument may be correct. I have chosen this topic because I am interested about cooking, through information, photos, videos, audio, and other in an attractive manner I will present various dishes around the world

4.1 Introduction

Food dishes evolved greatly with the progress of the ages, where human try since a presence of innovation and invention, and add whatever they wants to be able to survive, but a delicious way. Many foods in the world, there are thousands of different varieties to suit all tastes whatever; it is hot to the sweet, passing through the sour, salty and other sub-flavors, where many countries offer according to personal standards that each has a very special cuisine which has become famous around the world. George Bernard Shaw say "There is no sincerer love than the love of food", by looking at the number of amazing dishes around the world this argument may be correct. I have chosen this topic because I am interested about cooking, through information, photos, videos, audio, and other in an attractive manner I will present various dishes around the world.

Create a decent set personas helps us to prioritize new features of the site by looking at real people with backgrounds, goals and values, with a focus on their needs and expectations and how they are likely to use the site.

Examples of three different persons are:

- Person 1:

Noor is a 25 year old mother of one child, she spend her time on cooking. She use internet for more than year and she is comfortable using his mobile phone on free time, approximately she spends 3 hour in internet per week.

- Person 2:

Omer is a 30 year old father of three children, he is an engineer. Omer uses the computer at home; he feels comfortable using the computer. Engineers generally work in an office, Omer enjoys when researching on internet the information. He also uses the Web to check the weather, browse sites related to the dishes around the world because he is very interested in travel and try delicious recipes and follow-up golf tournament on the internet.

- Person 3:

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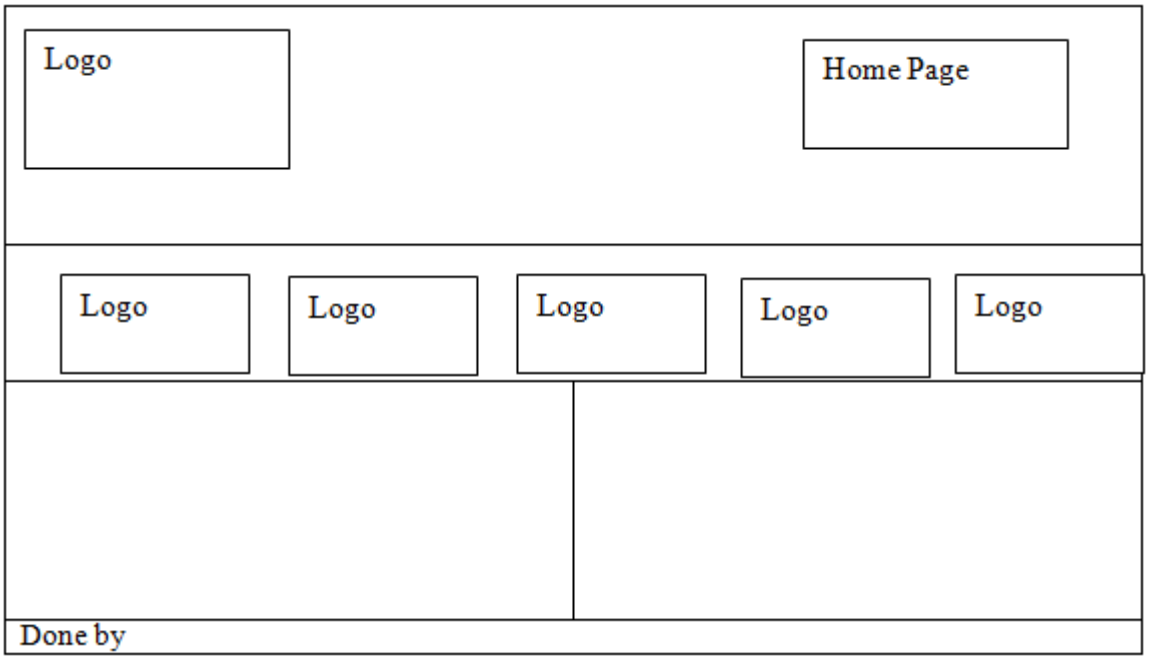
Reem is a 20 year old College Student, living alone. She often cooks for himself when she's at home, but combines this with eating out during the week with her friends. She spends her free time on reading and playing online games. Reem prefers to use her phone when searching information of assignments for the college.

4.2Story boards



1. **Design:**

Storyboards:

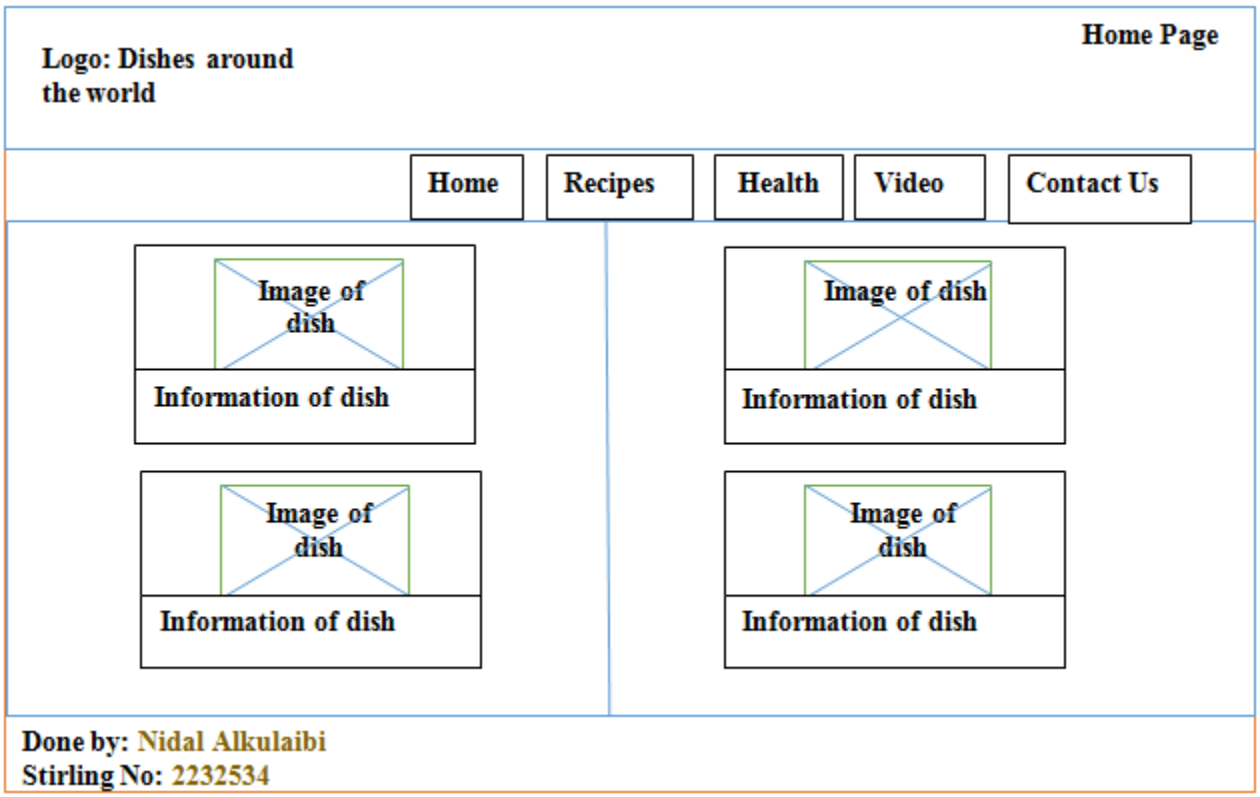


Figure 1: Home page

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Figure 1 displays the main page" Home page", when the user open this web site, it will shows the logo of web which is titled" Dishes around the world" from this message the user will automatically know what the website is about. The home page content the light color background and five buttons also it will display different dishes with small description of particular dish.

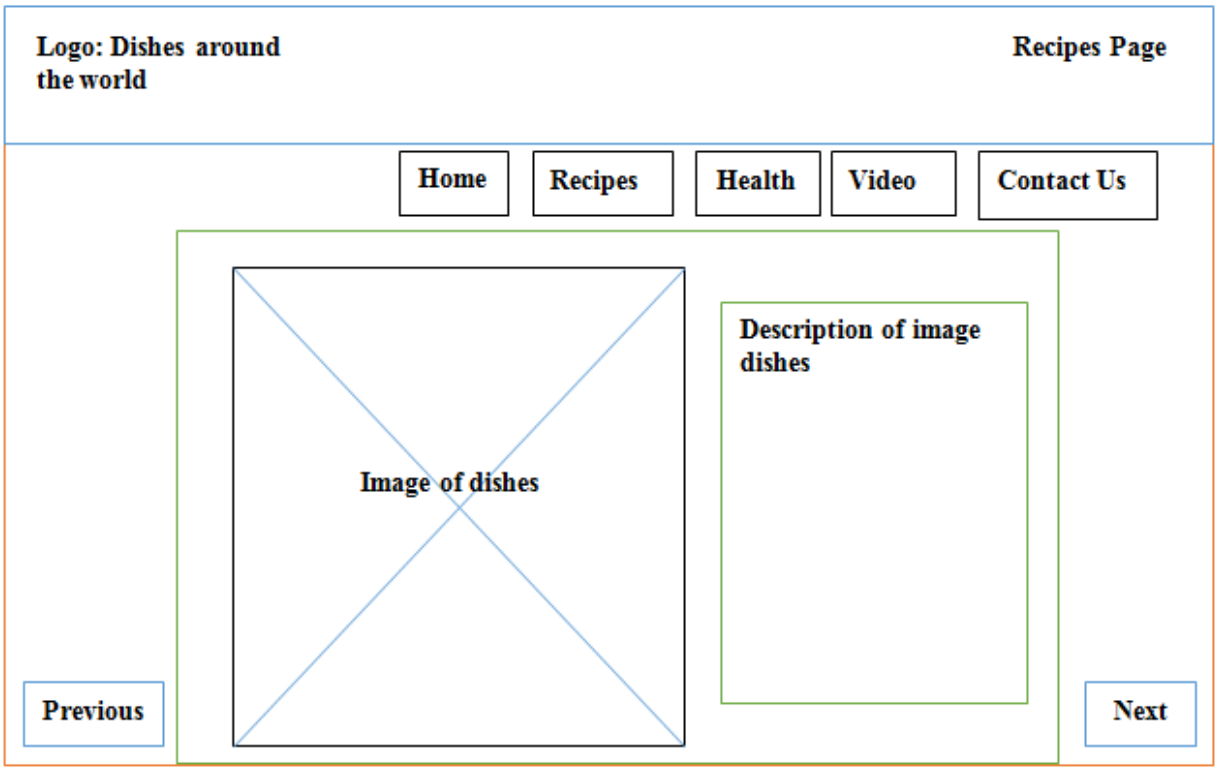

Figure 2: Recipes Page

Figure 2 show the second page" Recipes", I create in this page image slider with previous/next button. The function of previous/next button, allowing user navigate around images.

- If the current picture is the first picture, click the "Previous" button, the slider will go all the way to the last image.
- If the current picture is the last one, click on the "Next" button, the slider will go all the way to the first image.

Figure 3: Health Page

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Figure 3 show the "Health page", each category of people has a unique nutritional needs, this page contain three categories which are: Women's, Men's and Children's health. The user can get more information when they pressing on the link, it will display another html as shown in next storyboard.

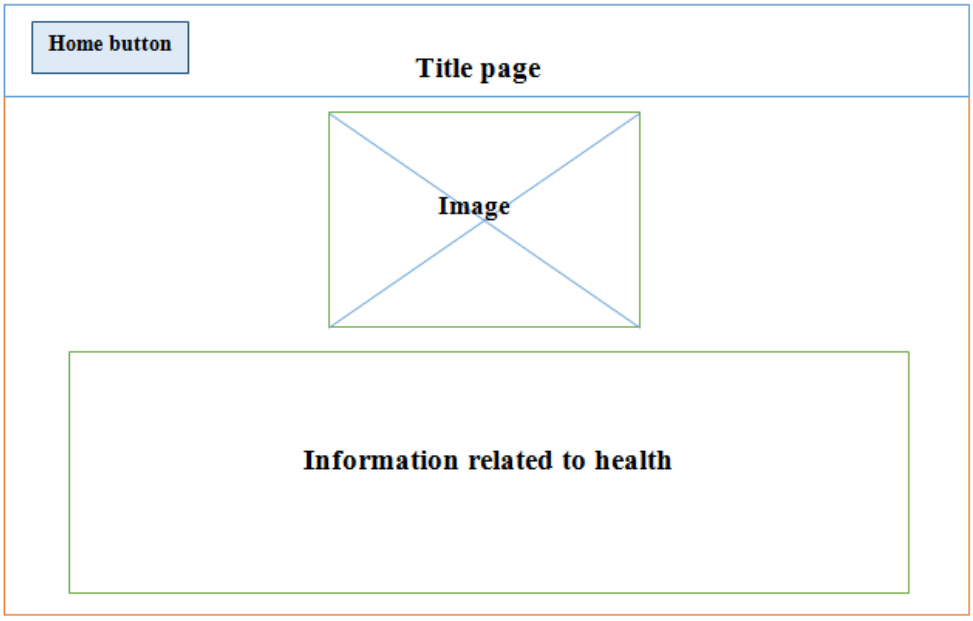

Figure 4: Link page

Figure 4, it is related to Health page, that displays information of specific category and some pictures. The page contain function, the user can refer to Home by pressing the button which is on top of the page.

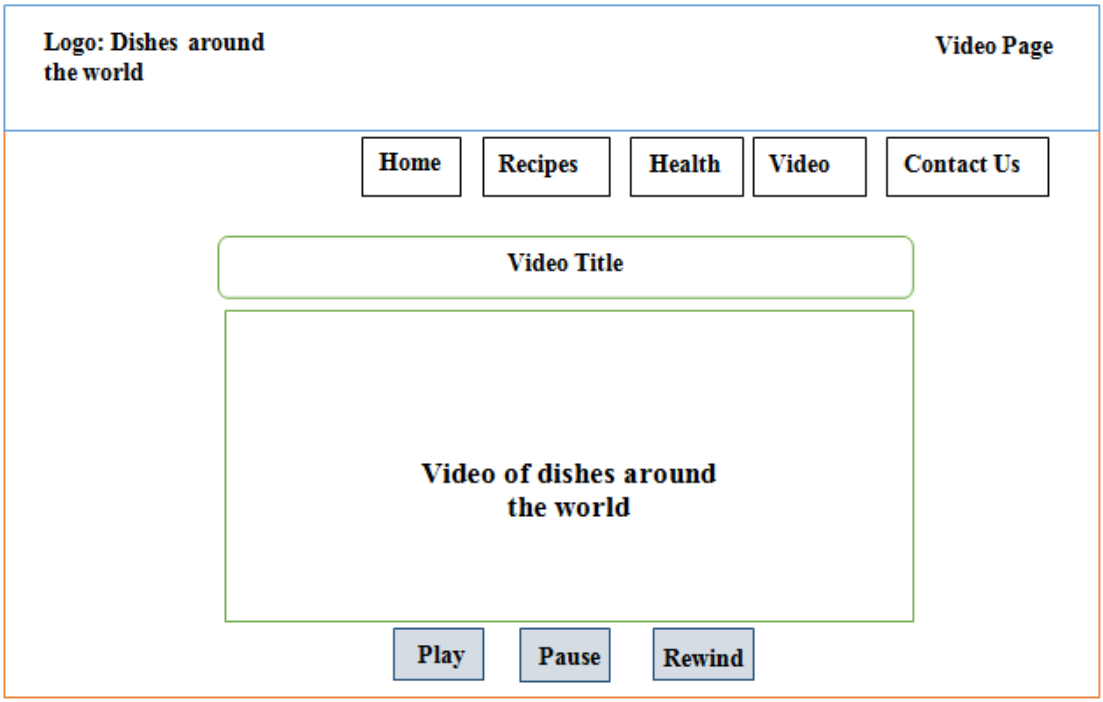

Figure 5: Video Page

Figure 5 shows "Video page" there are video about "The Most Popular Foods around the World" and the user can watch it by either clicking play button or control the video itself. There are three buttons on this page which are:

- Play button used to play the current video
- Pause button used to stop the video
- Rewind button used to rewind the current time video

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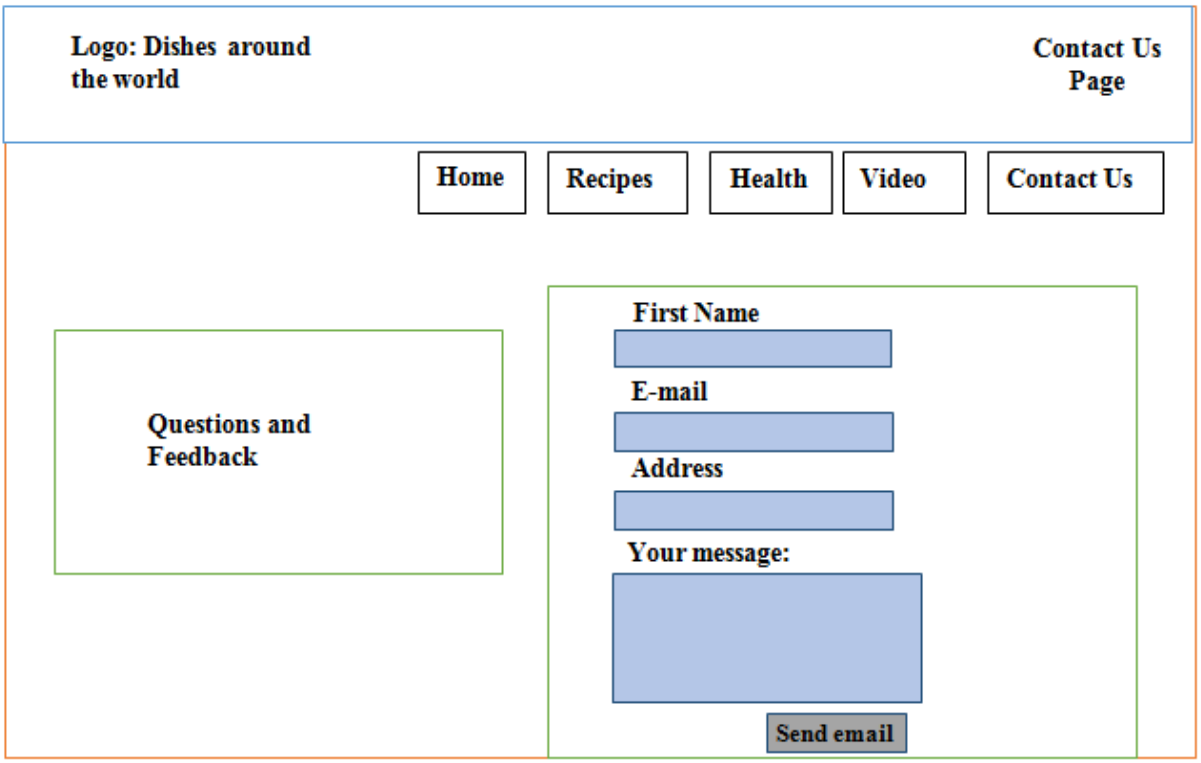
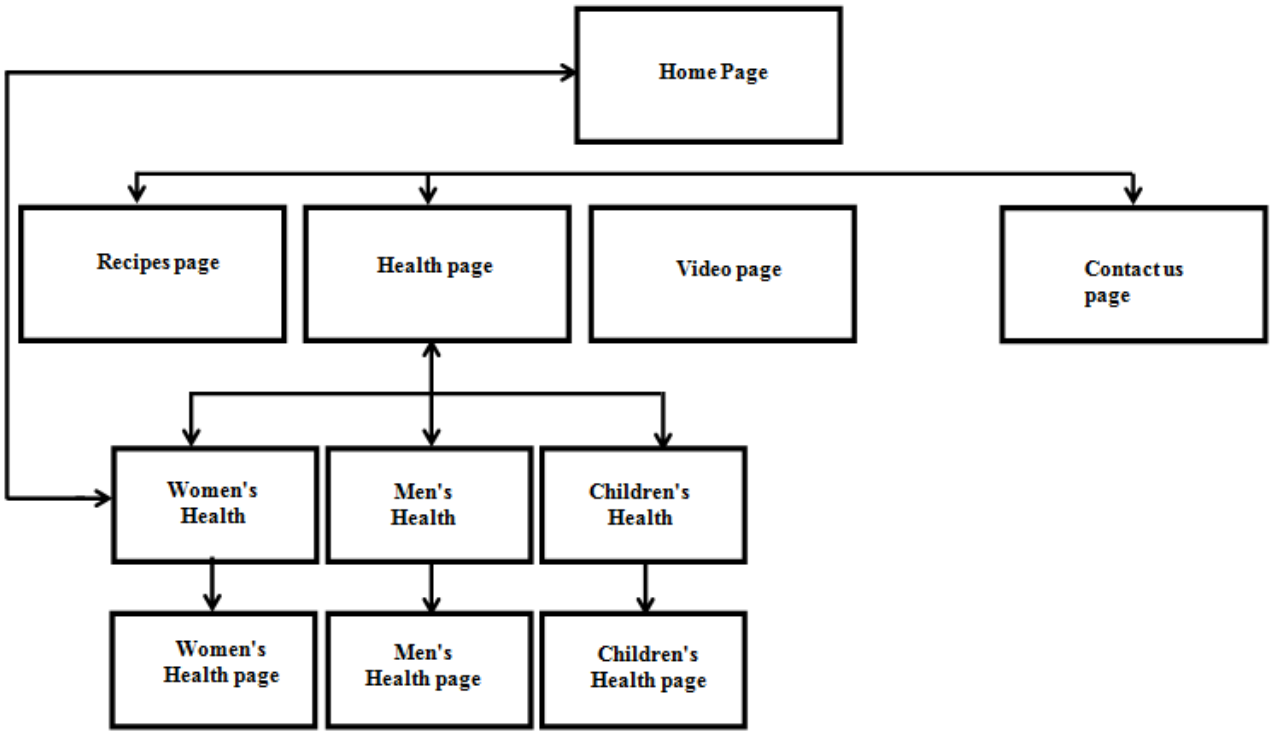


Figure 6: Contact Us page

Figure 6 show the "Contact us" page it is contain the questions and feedback, the user can send their questions and this page can also help them in their cause. The page there are some fields, the user have to complete it asks for your name, email, address and write your message or questions. Than they can press on "send email" button,

Navigational Maps



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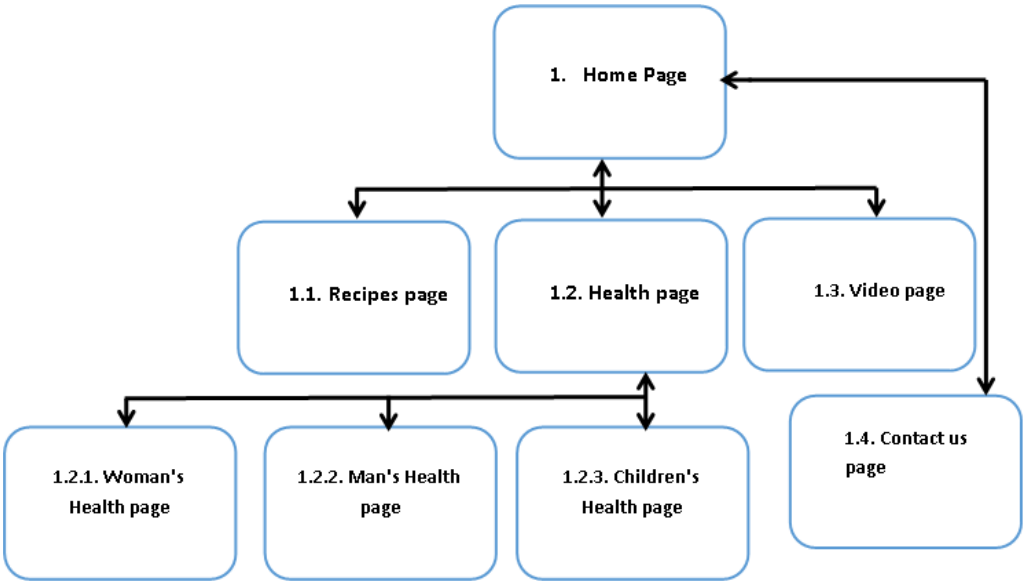
Hierarchical structure:

Navigation maps provide a hierarchical view of website and navigation paths, it is being developed at the initial stages of the design process. It provides a way to visualize the content and site navigation structures and it facilitates a top down design approach. Where the hierarchical design, starting from the home page, and passes to other pages.

Hierarchical Task Analysis diagram:



1. To present about dishes around the world. Press the Home button
2. See Home page is display different dishes
3. To zoom an image dish can be pressed in the picture
4. It will open a new page with a clearer picture
5. Press recipes button, to present the all recipes
6. Click next button to display British dish
7. That will move to next picture recipes
8. Click previous button to go back to the picture.
9. Back to Home, press on Home button

Prototype:

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2. Usability Testing

Test plan1:

CSCUMN5: Multimedia and HCI *PROJECT NAME: Dishes around the world*				
Test link :			**Candidate Name: Salim** **Candidate ID: 1233**	
Test Case : Man's health.html				
Test No.	***Test Item***	***Test Data***	***Input Data***	***Expected Result***
1	*Validation of Link page*			
1.1	Test for Health Page button	➢ Click Health Page button	Click Health Page	Display Health Page
1.2	Click here to Link	➢ Click here to Link	Click Link	Display the Man's health page

Test plan 2:

*CSCUMN5: **Multimedia and HCI*** *PROJECT NAME: **Dishes around the world***				
Test Video:			**Candidate Name: Amina** **Candidate ID: 1207**	
Test Case : Video.html				
Test No.	***Test Item***	***Test Data***	***Input Data***	***Expected Result***
2	*Validation of Video page*			
2.1	Test for Video Page button	➢ Click Video Page button	Click Video Page	Display Video Page
2.2	Click Play button	➢ Click Play button	Click Play	The Video will Starting play
2.3	Click Pause button	➢ Click Pause button	Click Pause	The Video will Stop
2.4	Click Rewind button	➢ Click Rewind button	Click Rewind	To rewind the current time video

After the prototype passes usability testing, where making a web site does not end with placing all media and software together. When did all the design, that have to test the site for the first time before being sent to the World Wide Web for the world to see. Some of the test types are functional tests, usability test and delivery to environment. Which will be checked for quality assurance is a multi-browser compatibility, loading time of the graphics, and flash components, or hardware requirements, and the requirements of memory size, and the connection speed from the user, and load. This test have checked through test three user, where testing how they are comfortable and easy using the website and get their feedback.

Application usability tests

Test user 1: Ibrahim, male 30 years old. He is very good computer skill with experience the basics of website design and programming languages. He says: "the web page is very easy, I did not find it difficult to use, but there is a problem in slower upload photos, the home page, and other things is smooth and easy to use." The problem has been modified on reduce the number of images in and make it smaller to load as quickly, and the number of users of your website can accommodate. Also notice that the load times of all contents of the website should be within an acceptable time.

Test user 2: Ahmed, Student of systems science program, 22 years old. Just modest computing skills, with experience the basics of website design but not programming languages. He says: "There are a number of different browsers and browser options. A website should be designed to be compatible for most browsers, but this web site does not! It is shown in a suitable position only in Google Chrome and not in the rest of the browsers." This is just about the form of the page but does not change the content of the browser to another. There are some things to check is centered things, and table layouts, colors, screen resolution, images, and buttons.

Test user 3: Noor, female around 25 years old, she has computing skills, with little experience on only programming. She says: "easy to use navigation from page to page through the buttons, also the picture is interested and a pleasant. I am interested in reading about health, so I click on health page, where there are three option links. When I choose Women's health, there is good information, but one thing does not functional properly which is option to go back, it goes to "Home page" rather than "Health page"." This options dose not functional yet

Multimedia is the texture of the text, graphics, sound, animation, videos and more. Although the description multimedia seems a simple, but the difficulty is to make it work efficiently and easily. I cover almost points in this design of web application by using HTML5, JS and CSS programs. In this report I discuss about the design which contains the storyboards, navigation maps and hierarchical tasks analysis. Also the description of full prototype contains. Finally description of the usability testing of two plan test and choosing three person test with collecting the feedback from them.

V. Conclusion and Future expansion

A project Based Learning approach is presented to teach HCI in computer science education. Knowledge is achieved in the area of HCI through all six levels of the revised blooms taxonomy. The project is prepared from scratch and student is doing each phase systematically as per the taxonomy. Through consistent learning methods such as tutorials, practical, class room discussions student is attaining the outcomes which are motivating the critical thinking of students. This course is highly appreciated by the students of every year due to the simplicity, chance of critical thinking, chance of innovation.

In future the course can be delivered online with more online video tutorials, virtual classes etc. to make a web based teaching of HCI.

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