

‘TOUCH AND RETRIEVE’-Information Retrieval System using Unified Technology Learning Platform (UTLP)

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Abstract— Information Retrieval is the technique of storing and recovering and often disseminating recorded data especially through the use of a computerized system. In this paper ‘TOUCH AND RETRIEVE’- an information retrieval system is developed for Siddaganga Institute of Technology. Features of UTLP such as Graphics LCD (GLCD) and Character LCD (CLCD) were used to retrieve the information. The GLCD is divided into four different quadrants to retrieve different information about the institute such as General Information, Courses Offered, Accommodation and Campus Map. The image uploading was the difficult task; it cannot be uploaded directly on GLCD. So, the image is converted to the header and included in the main program in order to display an image on GLCD. The GLCD is touch enabled so that the user can select any quadrant to retrieve the information about the institute.

Index Terms— Information Retrieval System; UTLP; Graphics LCD; Character LCD; GIMP Software

I. INTRODUCTION

The term "Information Retrieval" or IR was introduced by Calvin Mooers in 1951 and is defined as "Information retrieval is the name for the process or method whereby a future user of information is able to convert his need for material into an actual list of citations to documents in storage containing data useful to him. It is the verdict or discovery process with respect to stored data. It is another, more general, name for the production of a demand bibliography. Information retrieval holds the intellectual aspects of the description of information and its description for search, and also whatever systems, technique, or machines that are working to carry out the operation. Information retrieval is crucial to documentation and organization of knowledge [1]".

Conventional approaches for dealing with large collections of data originate from the discipline of librarianship. Commonly, items such as books or papers were indexed using cataloguing schemes. Eliot and Rose claim this approach to be millennia old: declaring Callimachus, a 3rd century BC Greek poet as the first person known to create a library catalogue. Enabling faster search of these physical records was long researched, for example, [2] Rudolph filed a US patent in 1891 for a machine composed of catalogue cards linked together,

which could be wound past a viewing window enabling rapid manual scanning of the catalogue. Soper filed a patent for a device in 1918, where catalogue cards with holes, related to categories, were aligned in front of each other to decide if there were entries in a group with a particular combination of classes. If light could be seen through the arrangement of cards, a match was found. This was the first information retrieval system in the history.

Information retrieval systems are everywhere: Web search engines, library catalogs, store catalogs, cookbook indexes, and so on. Information retrieval (IR), also called information storage and retrieval (ISR or ISAR) or information organization and retrieval, is the art and science of retrieving from a collection of items a subset that serves the user's purpose [3]. An IR System is a system capable of storing, retrieving, and upkeep of information; for example: Educational resources for a knowledge objective; Facts needed for determining on a company merger.

Many automatic information retrieval systems are experimental. One can only make occasional reference to operational systems. Experimental IR is mainly carried on in a 'laboratory' state whereas operational systems are commercial systems which charge for the facility they provide. Naturally the two systems are evaluated inversely. The 'real world' IR systems are evaluated in terms of 'user satisfaction' and the price the user is eager to pay for its

service [4]. Experimental IR systems are evaluated by comparing the recovery experiments with standards especially built for the purpose. In concern with the above facts, the following law concerning IR system has to be satisfied for the area of the current application on Information Retrieval system.

IR is a component of an information system. An information system must make sure that everybody it is intended to assist has the information needed to achieve tasks, resolve problems, and make assessments, no matter where that information is available. To this end, an information system must (1) enthusiastically find out what users need, (2) acquire documents (or computer programs, or products, or data items, and so on), resulting in a gathering, and (3) match documents with needs. Defining user needs involves studying user needs in general as a basis for designing responsive systems (such as defining what information students typically need for tasks), and actively soliciting the needs of specific users, expressed as query descriptions, so that the system can provide the information. Figuring out what information the user really needs to crack a problem is essential for successful retrieval. Matching involves taking a query description and finding related documents in the assembly; this is the task of the IR system.

Mooers' law states that "An information retrieval system will tend not to be used whenever it is more painful and troublesome for a customer to have information than for him not to have it". Accordingly, with due considerations to the objective of the law, "TOUCH AND RETRIEVE"- system of the institution Siddaganga Institute of Technology is developed. A menu is provided to the users with four options „General Information“, „Courses offered“, „Campus Map“ and „Boarding details“. The user can input choices through touch and corresponding details will be displayed on the display units.

The Information Retrieval System which is currently under the discussion consists of a software program in embedded C language in Eclipse Software with UTLP (Unified Technology Learning Platform) Kit that facilitates a user in finding the information the user needs regarding the Engineering College, Siddaganga Institute of Technology, Tumakuru. Chapter 2 throws light on the literature survey conducted during the beginning of the project. It consists of the questionnaire conducted, statistics (enclosed in the appendix) obtained and the various design options considered. Chapter 3 consists of the design decided as per the alternative selected. Chapter 4 explains the platform used and the features of the platform used. Chapter 5 explains the modular wise implementation of the

project. Chapter 6 illustrates the intermediate and final results.

II. HARDWARE IMPLEMENTATION USING UTLP

UTLP is based on Texas Instruments OMAP3530 application processor & Spartan-6 FPGA. The OMAP3530 processor supports interfaces such as Audio in & out, TV out, Touch screen LCD, Ethernet, Keypad, 2 SD cards & external interface connectors such as I2C Header for GPS, Bluetooth & Modem Connector, and Camera Connector & LCD connector. The Spartan-6 FPGA supports interfaces such as ADC, character LCD, DAC, Ethernet & external interfaces such as 70-pin IO expansion connector & 20-pin IO header. IP address of the kit: 192.168.2.80. The hardware diagram of the kit is as shown in Fig. 3. For the implementation of information retrieval system OMAP3530 application processor is used [5].

The UTLP kit runs on UBUNTU PC of version 12. The Embedded C code is generated using Eclipse software. The CLCD and GLCD already embedded on the kit were used for the implementation. The size of CLCD readily interfaced on the kit is 3.5 inch (320*240 pixels). Each pixel can be programmed to perform the following operations: Display and Touch. R, G and B are the primary colors. To display other colors trial and error method has to be used. It is placed in the arm processor part and hence can be directly accessed while coding using Embedded C. Different APIs were used for enabling and disabling the touch feature on GLCD. The 24 bit RGB and LCD control signals from OMAP 3530 processor has to be taken out to interface with GLCD. The signals coming out of the GLCD should be of 3.3v. The voltage levels of the signals coming out of OMAP is 1.8v hence level transistors are used in the internal circuit of GLCD to convert 1.8 level signals to 3.3 level signals. The SPI (serial peripheral interface) of the OMAP processor is used to communicate with serial interface based touch screen controller (TSC2046). The touch screen analog signals from the external LCD will be interfaced with touch screen controller through 4 pin 2.54mm pitch header. The touch screen analog signals from the 3.5inch LCD will be interfaced with touch screen controller through the 54 pin LCD connector.

The character LCD is used display both numbers and characters. The size of CLCD is 2*16 (2 rows, 16 columns). If the string size exceeds the limit of the CLCD an option to scroll the text either from left to right or right to left is provided. It is placed in the FPGA part of the kit and hence cannot be directly accessed while coding using Embedded C. Different API's is used start, initialize, display characters and stop the display. The software comprises of the FPGA Character LCD interface. The processor communicates with OMAP processor through

the Spartan 6 FPGA embedded inside the internal hardware of CLCD of UTLP.

III. DESIGN AND BLOCK DIAGRAM IMPLEMENTATION

Once the idea of the implementation was formulated, 2 sets of questionnaire were prepared and a survey was conducted to the end users (retail chain owners, common citizens, IT personnel). Three design options were provided to the end users. Based on the response to the survey, two statistics is plotted is as shown in Fig. 1 and Fig. 2 to finalize the design options and to know the area of application. Fig. 1 gives the statistics for selecting the different features for the implementation. Fig. 2 describes the statistics plotted based on the application area. Based on the statistics design options were finalized.

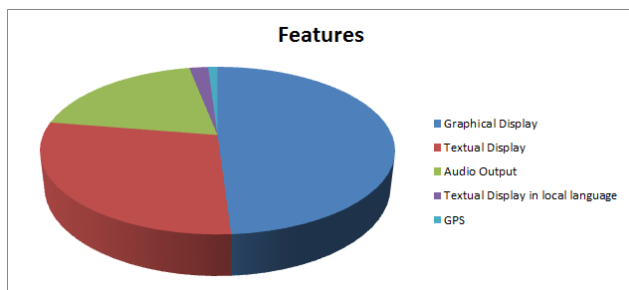


Fig. 1: Statistics to decide the features

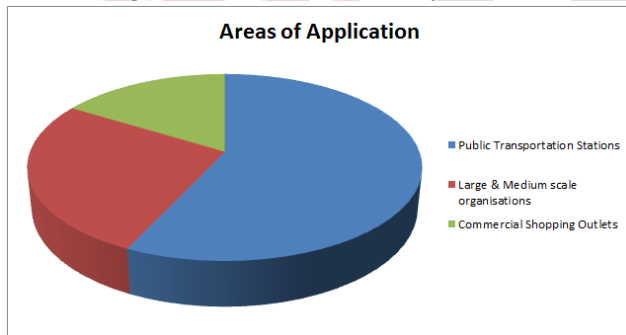


Fig. 2: Statistics based on area of application

As per the statistics obtained in Fig. 1, the users preferred GLCD (Graphics Liquid Crystal Display) and CLCD (Character LCD) in majority. GLCD provided the touch option and this provides an interactive approach. Embedded C provided a simpler approach for coding. The next step was to decide upon a media through which this idea could be implemented. UTLP (Unified Technological Learning Platform) was decided to be an apt platform to implement the idea since it already had a GLCD and a CLCD

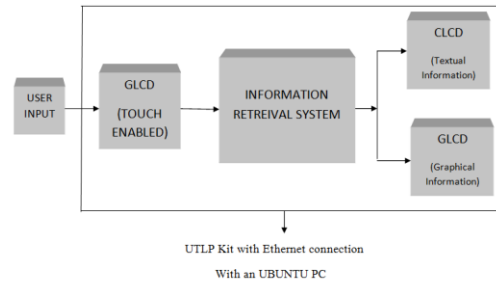


Fig. 4: Block Diagram of Information Retrieval System

The block diagram is as shown in Fig. 4. Consists of touch enabled GLCD and CLCD. The textual information and graphical information are displayed on CLCD and GLCD respectively. The screen of the GLCD is divided into four different parts to display the images for „General Information“, „Courses offered“, „Campus Map“ and „Boarding details“. The user can input choices through touch and corresponding details will be displayed on Graphics LCD and CLCD. When the user selects the general Information option the details about the college is displayed on character LCD. After displaying the complete information the user is asked to continue viewing the further details. Similarly the other details are retrieved using different display units. The detailed flow chart of information retrieval system is as shown in Fig. 5. The UTLP is connected to the using the Ethernet cable. The embedded c code written using eclipse software is loaded onto the kit using ULK panel [6].

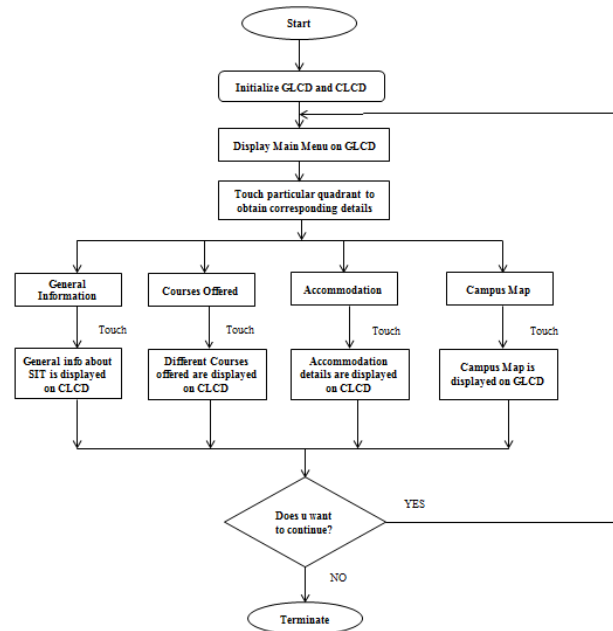


Fig. 5: Flow Chart of Information Retrieval System

Unified Technology Learning Kit (UTLP) comprises readily interfaced Graphics LCD and Character LCD. For the implementation following intermediate steps are as followed:

A. Dividing GLCD in to 4 Quadrants

The GLCD is of size 320x240 pixels. For filling color or displaying an image on the GLCD, each of these pixels has to be programmed. The co-ordinates of each point in GLCD has to be analyzed pixel wise in terms of the x and y co-ordinates as pixel.x and pixel.y (The x and y axes correspond to height (240 pixels) and width (320 pixels)). The range of each quadrant is hence determined as follows:

- Quadrant 1: $0 < \text{pixel.x} < 120$ and $160 < \text{pixel.y} < 240$
- Quadrant 2: $120 \leq \text{pixel.x} < 240$ and $160 \leq \text{pixel.y} < 240$
- Quadrant 3: $0 < \text{pixel.x} < 120$ and $0 < \text{pixel.y} < 160$
- Quadrant 4: $120 \leq \text{pixel.x} < 240$ and $0 < \text{pixel.y} < 160$

Once the GLCD is divided into 4 quadrants, images are displayed on each of these quadrants.

B. Enabling touch option of GLCD corresponding to each quadrant

Once the GLCD is divided in to quadrants, each quadrant has to be enabled with the touch option. The origin to display a particular thing on GLCD is top left corner and the origin to enable touch is bottom left corner of the GLCD. The co-ordinates for each quadrant to enable touch have to be analyzed again. Once the co-ordinates are found, they are used as a condition in an if-else ladder. Corresponding to each quadrant a statement has to be displayed on the control panel.

C. Synchronizing the outputs obtained on GLCD and CLCD

Once display and touch option of the four quadrants were synchronized, the GLCD and CLCD was synchronized. For this in each „if“ condition of the „if-else“ ladder, the CLCD was initialized and the corresponding output message was included in each corresponding quadrants

D. Displaying image on the GLCD

One of the main features of this system is to display images on the GLCD. The images cannot be displayed directly on the GLCD screen. So, in order to display an image, it is required to convert it into header file which can be included in the main code. To convert an image into header file GIMP software is used. The steps followed to convert an image into header file are as follows:

1. Resize/scale the image as per requirement.
2. Save the image as .xcf file

3. Export“ (converting an .xcf file to any of the provided extensions) the image to a header file (.h file).
4. Use the header file in the c program.

Once all the intermediate modules were implemented, the main program was coded by consolidating all the basic modules as per the requirement.

IV. RESULTS AND ANALYSIS

A. Intermediate Results

Displaying an image, dividing the GLCD into quadrants and touch enabling the GLCD are tested as the intermediate results. The image shown in Fig. 5 is displayed on the GLCD as the first trial. The displaying methodology involved conversion of a jpg image into a header file using GIMP software (the snap shot of the header file is shown in Fig. 6) and then inclusion of the created header file in the c-program.



Fig. 5: Example image displayed on GLCD

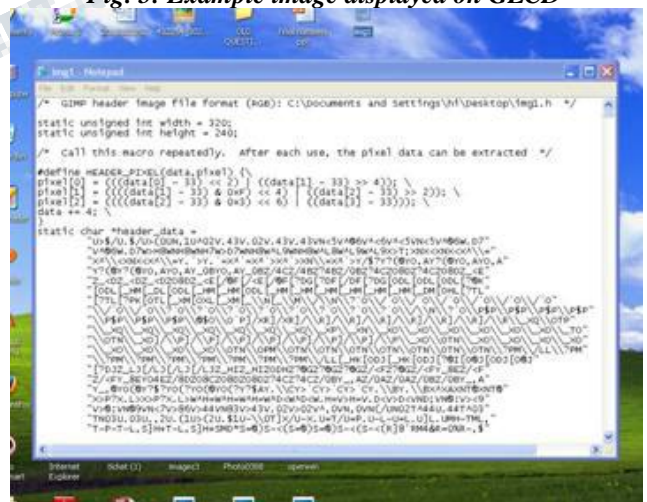


Fig. 6: Header File corresponding to image shown in Fig. 5

Division of the GLCD into four quadrants and displaying a particular color is as shown in Fig. 7. The GLCD is divided by fixing the range for the different

quadrants as discussed in IV and each quadrant filled with a particular color.

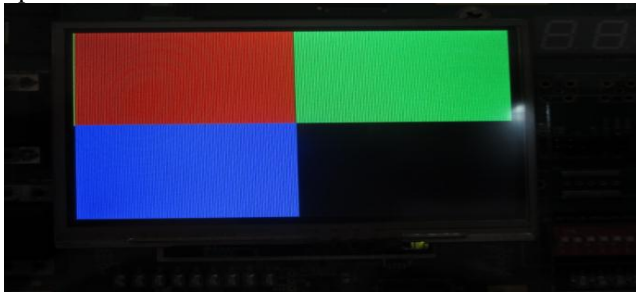


Fig 7: Division of the GLCD into four quadrants and filling different colors

B. Final Results

After dividing the GLCD into four quadrants and displaying images on the respective quadrants. Each image pertaining to the quadrant represents the following options to the user: General information, Course offered, Accommodation and campus map as shown in Fig. 8. Each image is converted into header file and included in the main program. This was followed by exploring of a touched quadrant by the user into another module. The GLCD which was in display mode was made touch enabled. 5

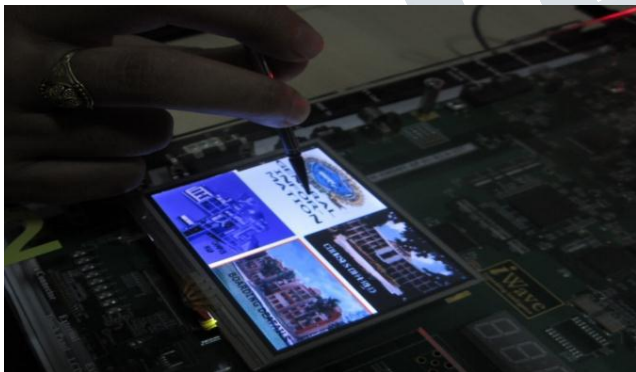


Fig. 8: Main Menu displaying all four option

When the first quadrant, General Info is touched by the user, the brief and basic information about Siddaganga Institute of Technology is displayed on CLCD unit as shown in Fig 9. The information is scrolled from left to right on the CLCD because of the size constraint. There is an option to get back to the main menu which requires the user to answer whether he/she wants to continue. This display is as shown in Fig 10. If the user touches yes again the main menu containing four options is displayed Similarly, when the second quadrant and third quadrant are touched by the user Courses offered and Accommodation details respectively are displayed on the CLCD, scrolling from left to right. Again, there is an option to get back to the main menu which requires the

user to answer whether he/she wants to continue. When the fourth quadrant, Campus map is touched by the user, the map of the institution is displayed on the GLCD as shown in Fig. 11, clearing the main menu

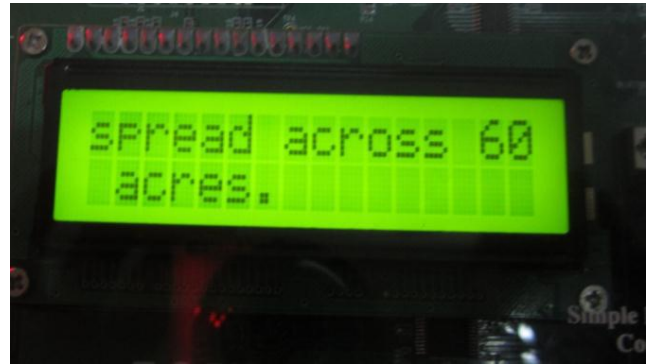


Fig.9: CLCD displaying General information of the College

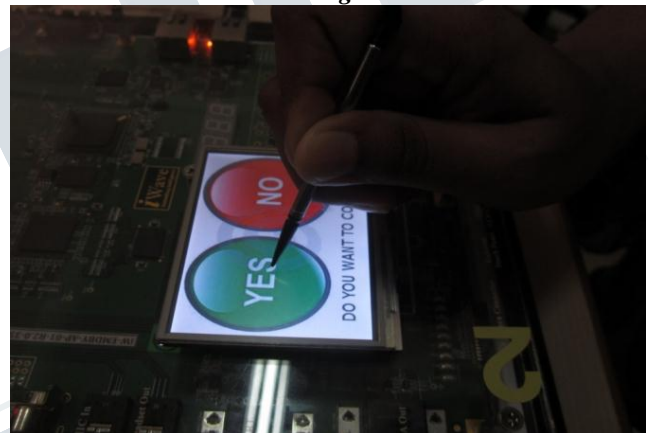


Fig 10: GLCD displaying options YES/NO option

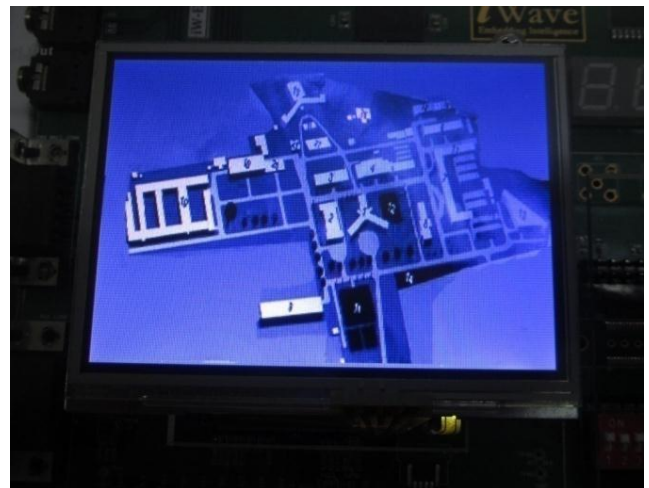


Fig. 11: Campus Map displayed on GLCD

After displaying the Campus Map, after sometime again the menu containing YES/NO options is displayed

on the GLCD. If the user wants to retrieve few more information from the system user needs to touch YES option if he want to exit from the system NO option is touched.

V. CONCLUSION AND FUTURE WORK

„TOUCH AND RETRIEVE“, gives a clear idea of an interactive Information retrieval system which describes in brief, Siddaganga Institute of Technology to the user which is accessed through touch. The project aimed at using UTLP because of the advantages it offered when compared to other alternative design options. The Embedded C language is used effectively for the same reasons. The main problems encountered during the project implementation such as uploading the images on GLCD and the conversion of .jpeg file to .h file. Introduction of various options for the user gave the opportunity to learn the proficiency of UTLP kit and Embedded C

The fundamental details of the institute like general information, courses offered, boarding details and campus map are displayed according to the user's choice within a touch, according to the objective of the project and thus provides an efficient and better platform for the retrieval of information. This model can be further improved by providing an audio output in both English and local languages. A GSM module can also be interfaced for instant communication with the institution officials.

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