RFID Enabled Virtual Guided Assistance System for Foreign Tourists

Ch. Subrahmanyam, Aditi G Nayak, AVSR Chandra Mouli, Rayala Varshini

Abstract— The language of the traveler might not always be known to the tourist guides, or the information available about the place might not be right, and moreover the charges of the guides might be too high. In the end, the travel experience and the place does not satisfy the tourists. In this paper, the development of a portable device is described, so that the tourists can experience a hassle-free tour. The implementation and demonstration of a complete system is discussed, which provides accurate information to the tourists along with visual guidance and assists them during their tour. This system makes use of two concepts, namely RFID technology and context aware information. This system can be used in several different locations like museum, zoo, historic monuments, tourist spots, government offices to provide the user with directions and information relevant to their location. The system can also be used as a monitoring device at research centers and hospitals.

Keywords : virtual guide, RFID, tourism, context aware system.

I. INTRODUCTION

Tourism is generally defined as the action or process of spending time away from their usual environment in the pursuit of pleasure, relaxation and recreation while utilizing the provisioned commercial services. The modern tourists can be widely classified in two categories: (1) active tourists, and (2) passive tourists. An active tourist usually prefers to plan a trip directly in his or her own way or along with friends'. Contrary to this, a tourist in a passive group usually follows a tied itinerary and a tour leader that is proposed by the travel agency along with fellow tourists. The virtual guide system described in this paper mainly concentrates on the active tourist group, which is now an increasing trend in the tourism industry. Tourism is considered one of the major resources of revenue in several countries including India. According to the World Travel and Tourism Council, the annual contribution of tourism to the GDP of India is 9.2% which is calculated to Rupees 16.91 Lakh Crore as of 2018. According to the Ministry of Tourism India, the annual growth rate of foreign tourist arrivals is 5.2% and that of domestic tourists visit is 11.9%.

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The system deals with the implementation of a flexible access system for the use in tourist places. The typical virtual guide user will be given a portable device which consists of an LCD screen and headphones for better understanding and experience of the accessed data. This device will help the user to access the information related to the location and its surroundings. This information is in the form of multimedia context including both video and audio experiences. The virtual guide first provides a brief summary of the complete monument after which the user can select the places or artifacts that he wishes to visit and can accordingly plan his tour all by himself. The tourist can independently explore the monument or other locations according to his interests and availability of the time. The context aware services are largely based on user location awareness. Based on this information, the system will adjust the content and services which will be displayed to the user. Context-awareness refers to the use of context information based on the surrounding conditions. A system is said to be context-aware if it is able to extract, decipher and utilize context information that is available and remodel its functionality based on the current context of use. The service aims to provide context aware access to communication, information and computation. The virtual guide utilizes the Ultra High Frequency (UHF) band permit and the Radio Frequency Identification (RFID) technology to provide access to the user. The concept of RFID plays a vital role in Virtual guide. The access to the user will be granted only when the RFID card is scanned and authentication is successful. If the RFID card that is scanned is not recognized by the system then the access to the information will be denied. This system ensures data security and avoids misuse of the data by unauthorized parties or individuals. The RFID technology provides access only within the short range of the reader. This way no two cards are read at the same time and the data interference problem is reduced to a great extent. Typically, a tourist could wander around the monument and be fascinated by the artifacts outside of the present tour he is following. To facilitate a dynamic adaption of the tour to the live position and varying interests of the user, we have improvised the existing mobile tour guide by including flexible and feasible visual displays and audio assistances to the tourists. This encourages the concept of active tourism making the tourists less dependent on the local guides, who sometimes can betray or manipulate the tourist with wrong information or higher tariffs. In some tourists' related applications, a concept edutainment is provisioned, in which a certain piece of information is learned and understood by means of multimedia. Multimedia technologies offer wide range of applications for learning while being entertained.

II. SYSTEM OVERVIEW

A. Flowchart

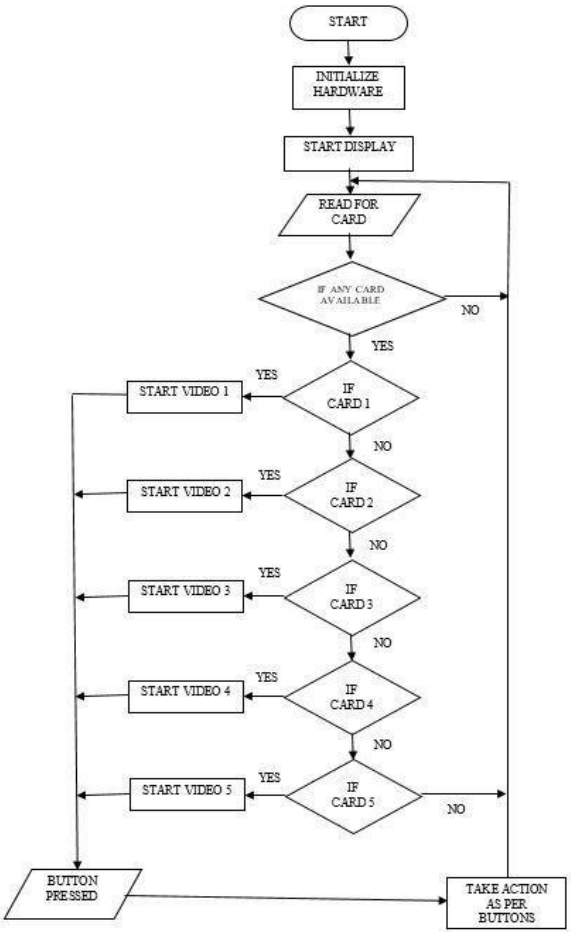

Fig. 1. Flowchart of the system operations

Step 1: When the power supply is connected to the module, the portable device starts.

Step 2: Now the system is initialized. The micro-controller activates all the hardware devices connected to it.

Step 3: The LCD screen will display the initial information to the tourists.

Step 4: The program now asks the user to "scan the card". The RFID card reader waits for the card to be scanned.

Step 5: Upon scanning, the RFID reader reads the card and processes the data. If the card is recognized then the respective video is played. If not, no video is displayed and goes back to read for card step. After the completion of the video, the same process is repeated for the next card being scanned. This can be extended to any number of cards.

Step 6: During the process of playing the video, if any of the buttons: play, pause, quit; is pressed, then action is performed accordingly. If pause button is pressed during the video, the video gets paused and plays only when the user presses the play button. If the play button is pressed when the video is already being played, no action is taken. Upon clicking the quit button, it asks for reconfirmation, if the user wishes to play the video again, to which the user can respond by pressing yes or no. After this, an appropriate action is taken by the system. If the user selects yes, then the same video is played again from the starting. If the user selects no, then the screen goes to its original form and waits for the next card to be scanned.

B. Block Diagram

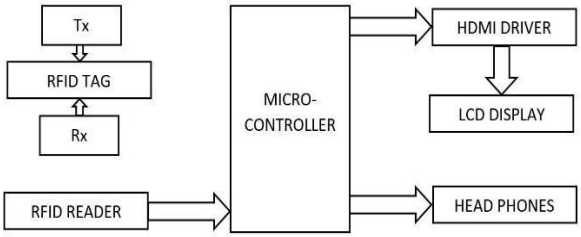

Fig. 2.System architecture

The virtual guide has been developed, which works on a portable device. It consists of self-defined and predefined tours for the tourists. In this system, the tourist utilizes the ultra-high frequency band which gives access to information retrieved through RFID enabled devices placed at the locations of the monuments. The system cited in this utilizes µRFID to avoid the issue of range. The portable device is equipped with LCD screen where the video information about the location is viewed by the user. The LCD is connected to the controller through a HDMI driver to avoid any attenuations and damages. The video is displayed when the tourist scans the RFID tag enabled at the Monuments.

III. SYSTEM ARCHITECTURE

A. Hardware Implementation

The system cited here consists of an exhibit's module and a tourist's module.

1) Tourist's Module:

a) µRFID reader: An µRFID reader is a low cost device that is used to scan an RFID tag. It can detect and scan any RFID tag which is within its range (10-15cm) and which operates on its working frequency(125kHz). It can be interfaced with a micro-controller in the two supported protocols namely Wiegand 26 and TTL Serial as per the system application. The reader consists of an antenna that emits radio frequencies and the tag responds to this by sending its data. The reader reads the frequency of the tag placed near the artifact. The reader passes this to the micro-controller for accessing the information which is related to the exhibit.

b) Micro-controller: The micro-controller is a device used to interface the RFID reader to the HDMI LCD display. The information of the tourist places is stored in this single board computer. When a tag is scanned, the RFID reader sends the data received from the card to the micro-controller, which authenticates the data of the tag and displays the respective information only if the tag is identified. The virtual guide developed here uses Raspberry Pi 3 Model B as a micro-controller. It is an ARM based Single Board Computer which runs a Debian based GNU/Linux operating system (Raspbian).

c) HDMI Driver*:* The HDMI Driver acts as an LCD driver board to interface the LCD screen with the micro- controller .HDMI Driver is used to import the videos stored in the micro-controller to the LCD display. It takes the HDMI data from the micro-controller and converts it to the TTL serial format and feeds this to the LCD display.

d) LCD Display: The LCD display is used to view the video information that is stored in the micro-controller when a particular RFID tag is scanned.

e) Headphones: The headphone which is to the micro-controller is used to access the audio information related to the video when a particular RFID tag is scanned.

2) Exhibit's Module

The exhibit's module consists of the RFID tags. Each tag has a unique identification number which is stored in an electronic form. The RFID tag consists of a tiny RF transmitter and a receiver. The receiver receives the encoded radio signal which is transmitted by the RFID reader to scan the tag. The transmitter responds by transmitting its unique ID to the reader. If this unique ID is identified by the RFID reader then the access is provided to the device. Else the authentication is not provided. The RFID tags do not require a battery, instead they use the radio energy transmitted from the reader as its energy source. This system design uses a method of distinguishing numerous tags which are within the RFID reader's range. This ensures that the accurate and relevant information is displayed to the user.

B. Software Implementation

The portable virtual guide system has been developed, which uses python language for building the program. This program is built in such a way that it provides access only to authenticated RFID tags. When an RFID tag is scanned and access is provided, the program transmits the information that is related to the particular tag to the HDMI driver port which in turn displays this data on the LCD screen. If any unauthorized card is scanned then it is not provided with the access and a message is displayed reading "No Video".

This program can be extended to several number of RFID tags and also to several locations around the globe. The program is dumped into the micro controller of the system for quick and easy access. Along with the program, the multimedia data is also stored in the micro-controller itself rather than being stored in cloud or other internet platforms. This enhances the response time of the device and makes it more quick, fast and efficient. The micro-controller used in the system has a memory of 32GB which can be extended up to 128GB, thus avoiding the problem of shortage of memory. To access this program there is no need for availability of internet or data, thus making this system effective even in rural locations. Python offers several options for developing a GUI (Graphical User Interface). Out of all the available methods Tkinter, a de-facto standard GUI, is the most commonly used method. This is the fastest and easiest way to create GUI applications. Tkinter is free software which is released under a Python license. The micro-controller uses the UART communication for interfacing the RFID reader and the HDMI LCD screen. UART stands for Universal Asynchronous Receiver/Transmitter. UART is not a communication protocol, but a physical circuit present in the micro-controller. The transmitting side in the UART converts the parallel data into a serial form and transmits it to the receiving side of the UART. This later converts the received serial data back into the original parallel form and sends this to the receiving device. In this way, communication is established between the RFID reader and the HDMI LCD screen through the micro- controller.

IV. RESULTS AND DISCUSSION

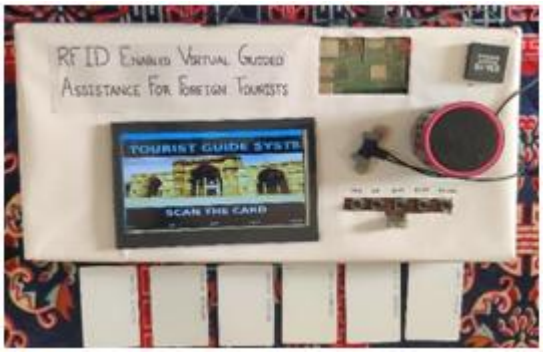

Fig. 3.Virtual guide model in a standby mode

Fig. 4.Virtual guide when a Tag is scanned and access is granted

The virtual guide system developed is a portable device which can be used by tourists and visitors during their tours to enhance the tourism experience and achieve greater levels of satisfaction . The RFID tags are placed near the exhibits of the tourist places. The user of this system can access the information of the place by scanning the RFID tag with the virtual guide. The system displays the information which is associated with the scanned RFID tag. The LCD HDMI screen displays the associated information in the form of a video and the head phones are connected to hear the audio output. If any tag is scanned which is not recognized by the system, then a message appears on the screen saying "no video". While playing any video if any of the available buttons is pressed, then the respective action is taken. The virtual guide first provides a brief summary of the complete monument after which the user can select the places or artifacts that he wishes to visit and can accordingly plan his tour all by himself. Using this device, the tourist can independently explore the monument or other locations according to his interests and availability of the time.

The system cited here helps in improving the quality and experience of the tour by providing accurate information in the form of entertaining multimedia. At the same time, it ensures that data security is maintained as authentication is provided only to recognized tags. The system also ensures that the problem of data interference is reduced as the tags used are valid and scanned only in the short range and do not interfere with any other reader or tag. Moreover, the RFID tags used in the system do not require any +maintenance and have a long operational life.

V. CONCLUSION

This paper has introduced a device for an adaptive virtual guide system. The tourists can have a rich experience of the tourism using this portable device to access the information about the exhibits and monuments. The system utilizes the RFID technology to access the relevant information. It will also include contextualized information which usually the human guides will not be able to provide. The device will decrease the cost of the tours and deceptions of the human guide by providing the authentic information. It also ensures information security by not providing access to unauthorized and unrecognized tags or cards. The system also solves the issue of data interference as the tags used in the system have a short range of access and do not interfere with other nearby tourist devices. This also encourages the concept of edutainment where the user can gain knowledge through entertaining visuals and multimedia.

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