Receiving Non-Contact Information About the Object through a Mobile Application

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Abstract: - The article introduces a mobile application that enables users to retrieve information about objects by simply approaching them with their phone. This eliminates the need for manual searching and allows for automatic retrieval of relevant information on the phone. This non-contact method of retrieving information makes it easier to preserve and utilize objects, saving time and resources.
The mobile application that has been developed comprises of various modules such as object identification, object data collection and processing, database modeling, and information retrieval. It has been implemented using modern technologies and equipment using Java language. This application can be used effectively in multiple fields such as museums, parks, medicine, education, among others. In the field of education, this app provides additional resources and a more interactive learning experience that goes beyond traditional textbooks or presentations.

Key-Words: - Mobile application, QR code, Augmented Reality, Barcode, Near Field Communication, Beacon Technology, education

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1 Introduction

In today's world, digital technologies are constantly evolving and have become an integral part of our lives. New devices are being developed to provide efficient solutions to various problems. The article explains how to obtain information about an object without making physical contact through the use of a smartphone.

This information can be retrieved in various formats such as images, texts, videos, etc. By scanning QR or barcodes on items, mobile applications can extract information linked to those codes from a URL or database [1, 2, 3].

Nowadays, it's possible to obtain information using augmented reality (AR) [4, 5, 6]. AR is a technology that projects digital content onto the real world through a device's camera. By pointing the camera at an object, the mobile application can recognize it and display relevant information or interactive elements on the screen. Some examples of AR devices include smartphones and tablets.

The process of adding supplementary elements to the existing information to complement non-contact data about the object being studied is known as augmented reality. This supplementary information can include details about the object's history, scientific properties or cultural significance, and can be displayed on the screen alongside the object. The information displayed can be tailored to suit different fields.

Augmented reality finds its applications in various fields such as museums, parks, education, medicine, and many others. By pointing their phones at designated spots, users can take virtual tours of museums, historical sites or natural attractions. By integrating non-contact information about the object into the educational process, students can become more engaged in the learning process and develop a greater interest in various subjects.

Our teaching experience has shown that incorporating mobile applications in the educational process to gather information on courses is highly beneficial.

2 Non-contact means of obtaining information

There are different ways to obtain information about an object using a phone, depending on the phone's capabilities and the type of information required. Some common search methods include using the internet to search for keywords related to the object, scanning barcodes or QR codes using mobile applications, and so on [7, 8].

Mobile applications can scan barcodes or QR codes from objects and retrieve information from a database or URL related to the code [9, 10]. Additionally, non-contact information about the object can also be obtained using various technologies available within the mobile application.

NFC, which stands for Near Field Communication, is a set of communication protocols that enables electronic devices such as smartphones, tablets, and other compatible devices to communicate with each other when they are brought close to each other [11]. In other words, NFC is a technology that allows devices in close proximity to communicate with each other. Additionally, NFC tags are physical objects that come equipped with NFC technology, which allows them to store and transmit data to NFC-enabled devices.

NFC tags are tiny electronic devices that can store data and communicate with other NFC-enabled devices when they are close to each other [12, 13]. These tags contain information that can be read by NFC-enabled devices like smartphones or tablets using NFC technology.

NFC tags are capable of storing various types of data, including URLs, text, contact information, or commands. These tags can be embedded in physical objects and can trigger actions. When scanned by a compatible mobile app, they can provide information about a particular object. By touching the phone to the NFC tag, the information stored on the tag can be retrieved [14, 15, 16] .

Beacons emit Bluetooth signals picked up by mobile devices. Applications determine user proximity to objects .

AR technology uses a device's camera to overlay digital information onto real-world objects viewed through a smartphone or tablet. AR technology projects digital content onto the real world through a device's camera. By pointing the camera at an object, a mobile application can recognize it and display relevant information or interactive elements on the screen.

Mobile devices are often equipped with sensors that provide contextual information about the user's surroundings. Apps can then use this information to obtain relevant details about nearby objects.

IoT devices with sensors can transmit data to mobile apps. For example, a smart home app can display temperature, energy usage, and device status [17, 18]. Mobile applications can provide users with non-contact information about nearby objects using a combination of technologies, each with its own advantages and limitations.

3 Stages of work of mobile application

The main function of a mobile application is to recognize objects and provide users with relevant information about them. The initial step in obtaining information about an object is identification. This is followed by creating a database, extracting necessary information from it, processing the data, and presenting it to the user.

Our application uses NFC tags, Bluetooth beacons, images, and software to identify objects. Since most modern smartphones have NFC compatibility, our NFC tags can perform various actions such as providing information or opening a web page. The Bluetooth beacon's identifier is processed by the mobile application's corresponding software module. This unique identifier is used to determine the device's physical location and trigger location-specific events, such as registering the device's location or receiving notifications. QR codes were used to provide images of objects in use inexpensively. These methods and devices can be customized or combined for various use cases, such as education, shopping, or museums.

Apart from identification, it was essential to gather information on the objects. The object data in the relevant program module has a specific format, including object name, description, picture, and other relevant details. The created structure guarantees the incorporation of diverse information.

The variety and uniqueness of objects around us make it difficult to categorize them based on common characteristics. Therefore, a non-relational data structure was chosen as a database model instead of a relational model, which requires a uniform structure for all data. The non-relational model is highly adaptable and user-friendly, allowing for distinct differentiation between all objects [19].

After the identification process is complete, data is retrieved from Firebase Realtime Database. The data is then processed and displayed to the user.

4 Software implementation of a mobile application

The software package has been developed using the Java programming language in the Android Studio environment. It is designed to be compatible with various types of phones. The Android operating system is built on the Linux kernel and features a virtual machine created by Google. Google provides libraries that are used by Java applications to manage devices [20, 21, 22].

The application's functionality can be divided into three main blocks. The first block of the application's work is the Scanner, which is designed to identify the object. The Scanner is followed by the Data Collector and the DataBase creation block. Basic information about objects is stored in the database. After receiving the identifier of the object from the Scanner, the corresponding information is obtained from the database.

After receiving the information from the base, the GUI-related block is already working, as a result of which the information about the object is displayed on the phone.

Software modules for activation of object identification equipment are developed with templates using appropriate Java language libraries.

The operation of each device was carried out by the corresponding software module. The DataCollector is designed according to the Singletone pattern because an application needs to have a single DataCollector. Receiving the identifier as input, it establishes a connection with the database and searches for the relevant information.

In the next step, the information display model InformationDialog(context,dataModel) works. In the DataBase block, the data is given according to scanner types such as description, id, title, image_url. Data can be added there using Firebase Functions using the Firebase Console. In the GUI block, the view of the information displayed to the user was implemented using the Dialog template.

In the created mobile application, it was very important to choose a database that does not have uniform data. One NoSQL database implementation is Firebase Realtime Database [19]. It is implemented by Google and provides convenient mechanisms for working with Mobile applications. Firebase Realtime Database allows you to create applications that have controlled access to the database.

In the developed mobile application, the data is presented locally, and if the device does not have an Internet connection at the moment, then real-time event changes will continue to reach the user the first time the Internet connection is restored.

When the device reconnects to the Internet, the Realtime Database synchronizes the local data with the data in the database and resolves the conflicts. Firebase Realtime Database can store large amounts of data without losing speed.

5 The use of information received about the object in the educational process

As university professors with years of experience, we are committed to improving the quality of education for our students. To this end, we have integrated the developed application into the educational process of master's students in our faculty. Our goal is to enhance the effectiveness of the learning process.

Since some subjects are taught on a voluntary basis, we have created QR codes for these subjects. Students can scan these codes with their phones to access websites, documents, or videos that provide relevant information about the subjects. This helps students choose a subject that aligns with their interests and goals.

In the upcoming years, we aim to utilize AR (Augmented Reality) technology for this specific purpose. Our main focus is on implementing AR applications that will enable students to access information in the form of 3D models and animated overlays by simply using their phones. Subjects may be taught with the support of educational materials such as encyclopedia applications, scholarly articles, and museum applications that offer detailed descriptions and multimedia content.

Integrating QR codes in the classroom can enhance learning by providing students with access to additional information, interactive resources, and multimedia content.

For the Data Structures and Machine Learning subjects taught in our faculty, we develop and use audio guides (podcasts) that students listen to on their phones while studying those subjects. Integrating phone-based information gathering into the learning process has increased student motivation, engagement, and curiosity in the subjects.

6 Conclusion

Within the framework of the development of the mobile application presented in this work, the problems of object identification, data collection, processing, database modeling and obtaining the required information were solved. We discovered

that obtaining non-contact information from objects doesn't have to be expensive. We utilized affordable and user-friendly technologies to achieve our goals.

Information that we receive can be processed using computers or mobile devices, which makes our lives easier and helps us manage large amounts of data comfortably. The developed application can be used to extract information from various objects in different fields, including education.

The integration of the developed application into the learning process provides more attractive, interactive and accessible learning for students. It increases their motivation and interest in different subjects. This approach allows them to discover the world around them in a new and interesting way.

We plan to integrate AI technologies into mobile apps that receive non-contact information to extend their functionality [23]. In this case, the application can recognize and analyze the characteristics and features of an object by pointing the device's camera at it.

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Contribution of Individual Authors to the Creation of a Scientific Article (Ghostwriting Policy)

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Anna Hovakimyan implemented some program blocks of the application.

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Conflict of Interest
The authors have no conflicts of interest to declare that are relevant to the content of this article.

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