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Digitalizing Green: QR Code Based Plant Accessing System For Awareness And Conservation

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Abstract
In an era where Urbanization and environmental degradation challenge the health of natural Ecosystem, the connection between people and nature diminishes, leading to a loss of awareness about the importance of biodiversity, particularly trees. This paper presents the results of a survey conducted at the RIT College campus in 2024, aimed at documenting the plant species present and categorizing them based on their fruit-bearing, Flower-bearing, medicinal benefits, and other uses, including industrial and ecological applications .We have created a PDF document containing detailed information about the plant, which will be used to generate a QR code for easy access. The QR codes providing detailed plant information are implanting on specific plants across the campus. This innovation allowed students, faculty, and visitors to interact with the campus flora by scanning the QR codes. The initiative received positive feedback, showcasing its role in fostering environmental awareness and engagement while promoting the significance of campus biodiversity. This paper explores the potential of QR code-based systems to enhance the accessibility of tree-related information, examining their technical implementation, case studies, and broader implications for ecological education, public engagement, and environmental conservation.

Keywords: *Biodiversity, QR code, Natural Ecosystem*

1. Introduction
As the global community increasingly values sustainability, conservation, and biodiversity, there is a growing need for accessible, accurate information on natural resources. Trees, as a cornerstone of ecosystems, provide a wide range of ecological, medicinal, and cultural benefits. However, valuable information about tree species, including their medicinal properties, common names, and ecological roles, often remains inaccessible to the general public and even researchers in the field. This lack of accessible data limits awareness and engagement with natural resources, particularly in urban settings where interactions with nature are often limited [1][2][3]. QR code-based information access presents an innovative solution to bridge this gap. By linking QR codes to comprehensive databases, individuals can access detailed information about specific trees simply by scanning a code with a smartphone. This Approach can enrich users' understanding of each tree's unique characteristics, such as its medicinal applications, cultural significance, lifecycle, and ecological benefits. For example, a passerby in a park could quickly learn about a tree's traditional medicinal uses, while a researcher could access data on the tree's age, growth patterns, and environmental impact [4] [5]. Such a system also benefits conservation efforts, education, and urban planning. For researchers, QR codes streamline data collection, enabling real-time monitoring and historical tracking of individual trees. For educators and environmental organizations, it provides an interactive learning tool, fostering a deeper connection between individuals and their natural surroundings [6][7]. This approach not only supports practical research but also promotes public engagement with trees and nature, increasing awareness about their ecological importance.

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This paper explores the potential of QR code-based information systems as a tool for enhancing tree data accessibility and awareness. It discusses the technical and practical aspects of implementation, examines case studies where similar systems have been applied, and considers the broader implications for ecological education, public engagement, and environmental conservation. By making tree-related information easily accessible, this system encourages a more informed, engaged, and environmentally conscious society [8] [9].

2. Literature Review

The integration of Information and Communication Technology (ICT) for tree identification has significantly enhanced accessibility and efficiency in both educational and conservation efforts. One widely used ICT tool is the barcode system, which allows for quick and easy identification of tree species. Studies have demonstrated that barcodes facilitate rapid access to tree-related information, enabling users to bypass the need for expert knowledge or physical reference books. This system is particularly advantageous in settings such as eco-tourism, where tourists can quickly scan a barcode to learn about tree species without relying on tour guides, as noted by Miniaouiet al. (2018). Barcodes have thus revolutionized the way tree identification and information retrieval is conducted, making the process more engaging and accessible [10] [11] [12]. A further enhancement to the tree identification process is the use of QR codes, which are gaining popularity for their ability to link to digital resources through mobile devices. In a study conducted by Pratiwi et al. (2024), QR codes were utilized for plant identification at Raden Intan Lampung State Islamic University. This approach allows visitors and students to easily scan QR codes placed near trees to access detailed information on the species, origin, and care instructions, enhancing the learning experience and making tree identification more interactive. Similar systems, such as the tree tagging initiative at Universities Putra Malaysia's Sultan Idris Shah Forest Education Center, have also shown how QR codes can assist in providing real-time plant data to visitors, improving the overall experience and facilitating knowledge dissemination through mobile technology [13][14]. Despite the success of these systems, many tree identification methods in some regions still rely on traditional, manual techniques, which are time-consuming and require a certain level of expertise in taxonomy. As highlighted by Atalla et al. (2023), the lack of accessible ICT solutions makes tree identification, challenging task for the general public. To address this, the development of user-friendly ICT systems, such as QR code-based tree identification tools, is essential to making tree information more accessible. Such systems not only offer ease of use but also provide more engaging and interactive ways for people to learn about trees, ensuring broader public engagement and improving tree management and conservation efforts in the long run [15].

3. Methodology

3.1 Study Area

An initial survey was conducted within our college campus the survey was undertaken within Rajarambapu institute of technology located in Islampur (Rajaramnagar) the aim is to expand detailed information related to the plant which is inside the college campus. Using GPS essential app we added the exact location of that particular tree https://maps.app.goo.gl/gdtn94SdBSVpt9Ls6.Figure 1 RIT Collage Survey,

Figure 1 RIT Collage Survey

3.2 Data Collection

After completion of our college survey, were collected from RIT College Campus which was necessary to get the information of the tree One crucial aspect of this survey was identifying specific areas where data collection would occur. Comprehensive information on each tree species (botanical name, common name, family name etc) was acquired with the assistance of an experienced

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gardener Simultaneously, We also added some relevant images of the tree Other information on the industrial uses, miscellaneous, were also sourced from existing literature and other sources.

3.3 Database Structure

The data requirements for the tree information database included tree species common, Botanical, IUCN Status, family, Native, flowering and fruiting month, and uses. Data sources, such as photographs and tree position coordinates, were also used to complement the tree information. We are also provided the Green Data in which included the total no. of flowering tree, no of shrubs etc which is inside the college campus. This all data we can collated on the basis of the survey we complete our survey by using of different GPS essential apps to getting proper location, photographs, waypoint of the tree

3.4 Green Data

At RIT College, we conducted a survey of the college campus. According to that we count the total no of trees and they are classify into different categories like the flowering, fruiting and other tree The main purpose was to identify and classify the various plants and trees across college campus and to promote their importance by using QR code Figure 3 Distribution of Plants, Figure 4 Graphical Representation of Flowering Plant, Figure 5 Graphical Representation of Fruiting Plant.

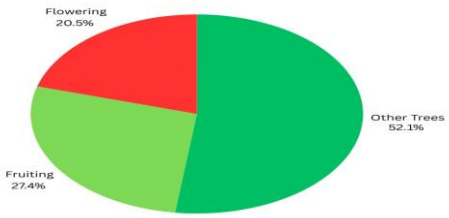

Figure 3 Distribution of Plants

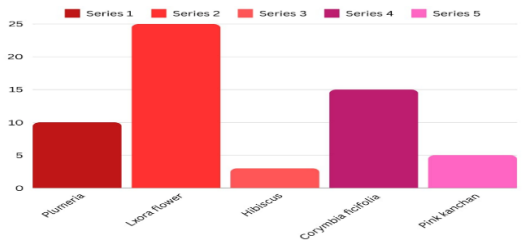

Figure 4 Graphical Representation of Flowering Plant

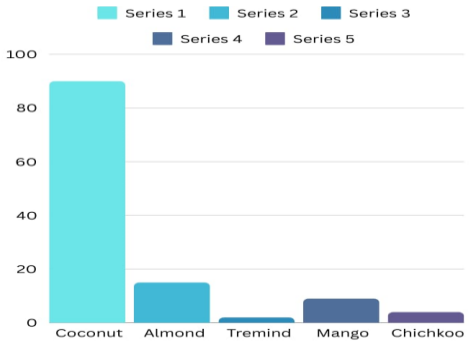

Figure 5 Graphical Representation of Fruiting Plant

3.4.1 Flowering Plant

Table 1 Flowering Plant

Name of flower	Count tree
Plumeria	10
Golden Thryallis	02
Jasmine	02
Kaner	02
Bahara	03
Ixora flower	25
corymbia ficifolia	15
Sonchafa	01
Bougainvillea glabra	02
Pink kanchan	05
Chafa	03
Gulmohar	04
Hibiscus	03
Periwinkle	01
Rose	04
Lotus	01
Hamelia-patens	04
Kardal	04
Arabian-jasmine	02

3.4.2 Fruiting Plant

Table 2 Fruiting Plant

Name of fruit	Total Count
Coconut	90
Almond	15
Mango	09
Chikoo	04
Tamrind	02
Jamun	01
Umber	02
Sitafal	01

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3.4.3 Other Plant

Table 3 Other Plant

Name of Plant	Count of Tree
karanj	03
Foxtail	27
Bamboo	45
Neem	08
Nilgiri	27
Baniyan	03
Pimpal	01
Black ficus	20
Saphora	02
Kadamb	01
Acacia	07
Nilgiri	06
Chandan	02
Rain tree	06
Silver oak	11
Christmas	07
Ashok	67

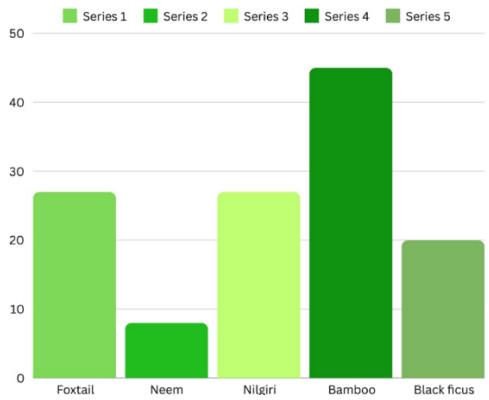

Figure 6 Graphical Representation of Other Plant

3.5 Forest Conservation Area

Our college has a forest conservation area with 220 Sagwan trees in 2000 sq M. This area is maintained with plantation. Forest conservation area provides multiple benefits including environmental conservation, support wildlife, maintain biodiversity and it is also used to help protect nature and wildlife.

3.6 Some Information

Sagwan tree commonly known as Teak. It is from Lamiaceae family. South and southeast Asia is the native of Sagwan tree .It grows up to 30-40 meter tall and it has strength trunk. Leaves of sagwan trees are large. Table 1 Flowering Plant, Table 2 Fruiting Plant, Table 3 Other Plant, Figure 6 Graphical Representation of Other Plant.

3.7 Cultivation

- **Soil:** Grows well in deep or volcanic soil
- **Growth rate:** slow growing rate
- **Climate:** It requires a warm and humid climate

3.8 Economics Value

Sagwan is the most expensive wood in the world it is a major export in Myanmar and Indonesia countries

3.9 Uses

It is used in High quality timber, boat building carving and handicrafts, environmental benefits, wildlife habitat etc and sagwan trees also provide some medicinal uses such as

- Skin Health: The bark is used in traditional medicine to treat skin diseases and wounds.
- Digestive Aid: Bark extracts are used to treat diarrhoea and dysentery.
- Anti-Inflammatory: Leaves and bark are used to reduce inflammation and swelling.
- Antimicrobial Properties: Teak wood has natural oils that exhibit antimicrobial and antifungal properties. Figure 7 shows Forest Conservation in RIT College Campus
- Fever Reduction: Decoctions of teak bark are used in traditional medicine to reduce fever.

3.10Benefits

- Export Revenue
- carbon sequestration
- soil conservation
- construction
- Marine application

Figure 7 Forest Conservation in RIT College Campus

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4. Results- System Development

4.1 QR Code Generation

We can generate QR which is based on the pdf of the particular tree which is provided the information using different QR code Generator application to create efficient QR code like https://goqr.me/ and other website based Figure 8 QR code of Plumeria.

Figure 8 QR code of Plumeria

4.2 QR Code Translator

- Scanning a QR code is easy and can be done using a smartphone or tablet.
- Open camera of your smartphone or Google lens
- Ensure the code is in the frame.
- URL will appear. tap on it
- This will open the linked content in your browser or app. Figure 9 QR Code Translator

Figure 9 QR Code Translator

4.3 PDF Format

We create the pdf of the tree in which include tree species common Botanical, IUCN Status, family, Native, flowering and fruiting month, and uses. Data sources, such as photographs and tree position coordinates, were also used to complement the tree information. Figure 9 shows Plumeria, Figure 10 shows Medicinal Use, Figure 11 shows Miscellaneous.

Figure 9 Plumeria

Figure 10 Medicinal Use

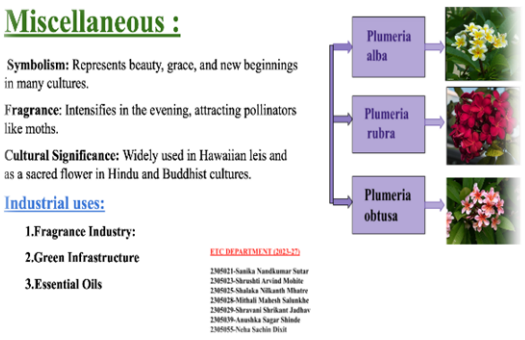

Figure 11 Miscellaneous

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4.4 QR Code Format

We have implemented this QR code format that provides access to detailed information about the Plumeria plant. These QR codes are strategically placed on various Plumeria plants within the campus. When scanned by visitors and students, the QR codes offer instant access to valuable information and other relevant details. This initiative aims to enhance awareness and foster a deeper understanding of the campus flora Figure 12 shows QR Code Format.

Figure 12 QR Code Format

4.5 Key Features of the Tree Information System (TIS)

4.5.1 QR Codes & Centralized Database

Each tree has a QR code linking to detailed tree information (name, species, uses(medical, industrial).

4.5.2 User-friendly Interface:

- Easily accessible via smartphone by scanning QR codes.
- Simple, intuitive design for all users.
- Easy to understand the information language

4.5.3 Educational Content for college faculty and student:

- To guides, conservation tips, and detailed botanical data and
- Provided the proper and accurate information about plant and their species.

4.5.4 Community Engagement

- Integration with tree planting events and guided nature walks.
- Volunteering opportunities for local conservation.
- Collaborative mapping of local trees by users.

4.5.5 Data Analytics

- Track user engagement (scans, content interaction).
- Monitor tree health and user-reported data to spot trends.
- Help in planning community and environmental efforts.

4.5.6 Additional Features

- Geolocation: Guides users to nearby trees of interest.

4.5.7 Benefits

- Promotes environmental education and awareness.
- Fosters community involvement in tree care and conservation.
- Provides data-driven insights for tree health

4.6 Interface Design

The QR code system designed for accessing information about the plant is built with a focus on simplicity, eco-friendliness, and user accessibility. The codes are created with a clean, minimalistic design, ensuring ease of scanning without overwhelming the user. Positioned strategically on or near the Plumeria plants, the codes are easily visible and accessible, allowing visitors and students to quickly engage with the content. The labels are printed on eco-friendly materials, such as recycled paper or biodegradable options, aligning with the campus's commitment to sustainability. Upon scanning, users are directed to a mobile-friendly platform that presents clear, concise, and interactive information about the particular plant, including its origin, care instructions, medicinal properties, and unique features. The design ensures that the platform is intuitive, with easy navigation and engaging multimedia elements such as images, videos, and audio clips that enhance the learning experience.

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Issue:01 January 2025
Page No: 72-80

4.7 Feedback

We developed a feedback form using Google Forms to collect responses from students, faculty, and other visitors who scanned the QR code. Based on the collected data, we received positive feedback regarding the system's effectiveness and user experience. This feedback has been valuable in assessing the impact of the application and identifying areas for further improvement. Figure 13 shows Feedback of Q1, Figure 14 shows Feedback of Q2, Figure 15 shows Feedback of Q3, Figure 14 shows Feedback of Q4

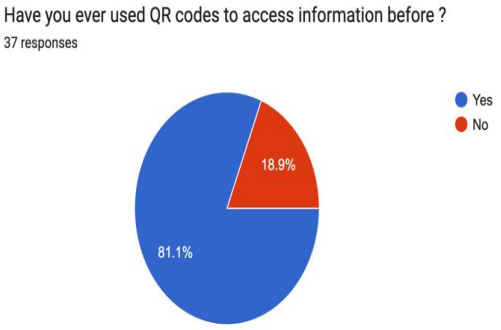

Figure 13 Feedback of Q1

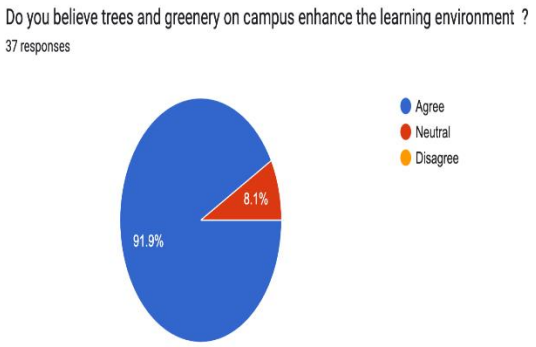

Figure 14 Feedback of Q2

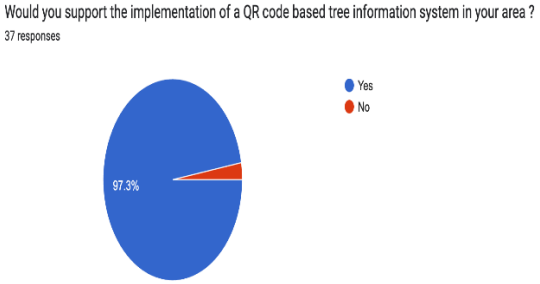

Figure 15 Feedback of Q3

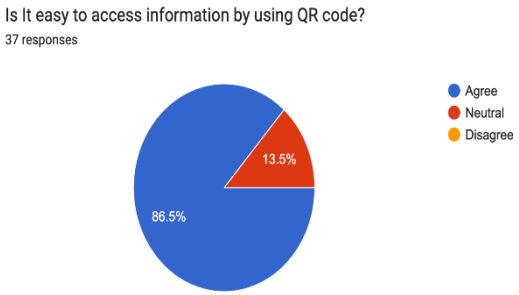

Figure 14 Feedback of Q4

5. Problem Statement

As we know that the importance of trees in our life is very necessary so that's why we need to know knowledge or basic information about trees. According to ayurveda many trees or plant listed that have medicinal value which cures the major diseases problem related to human being .Hence for solving this problem, we can attach well programmed are codes which will contain proper information about that tree or plant including its common name, botanical name, medicinal uses.

5.1 Objectives

The objective of our project is to develop a QR code based tree information System for awareness and Conservation, few more objectives are as follow:

- To student/staff or visitors know more about the trees which is present in our college Campus.
- Students can learn about the species, Characteristics, ecological importance and benefits of trees.
- QR codes can help increase awareness about the Importance of plants/trees and their role in daily life.
- To people understand the importance of preserving trees and their habits.

5.2 Scope

The scope for using QR code based plant information accessing system to obtain the proper information is vast and significance in field of environmental studies and other fields also like education, agriculture etc Here's the overview of the scope for Digitalizing Green

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Page No: 72-80

5.2.1 Plant Recognition

by scanning the QR code associated with specific plant in campus the user can get information which is linked to the database of plant at back end the user get the quick access to the information of plant like common name, botanical name, family, IUCN status and mainly its significance in many fields Also for virtual verification user can go through the image of plant also recognizable parts of plant like fruits or flowers

5.2.2 Educational

QR code based system can enhance the educational system by making students Enthusiast to study the nature and its great significance to human life. The QR codes can be implemented to allow the visitors and new learners to get access to plant information

5.2.3 Conservations

The QR codes containing the plant significance can be used to aware the people for the conservation of special species. The nature conservation organizations can apply such QR code techniques to preserve the endangered and threatened species of plants it will help to engage the people in conservation drive

6. Future Scope

It has vast future scope of generating and implementing QR codes. It holds the significant potential to engage the people also making it more advanced in future in following areas

6.1 Integrating with Technologies

As the technology involves the engagement in QR code based plant information accessing systems. The use of emerging technologies can give more benefits. The technologies like Internet of things or Artificial intelligence can increase the versatility of the QR code system

6.2 Personalization

By accessing the QR codes and introducing to artificial intelligence and machine learning algorithms to analyse the user by recognizing the scanning pattern and deliver the specific information in case

6.3 Increased Data Virtualization and Interactive Display

The user can be engaged in such way that he could get the 3D mapping of same trees in campus area, it could contain some informational videos and documentaries

Conclusion

Using QR codes on trees offers a new way to share information about nature. By scanning a code anyone can instantly learn about a plants species, health. This tool helps researchers track trees over time and supports conservation by making data easy to update and share. It can be used in parks, forests, and schools to engage the public, raise awareness and promote sustainable practices. This technology builds a stronger bond between people and the environment

Acknowledgements

"We are grateful to everyone who helped make this plant information system using QR code possible. Thanks for the support of our college faculty, and agriculture team, we can now provide easy accessible information about plants on campus through QR codes. We hope this system enhances learning and encourages everyone to connect more deeply with our natural surroundings. Thank you for supporting this initiative!"

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