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FACULTY OF ENGINEERING AND TECHNOLOGY

COMPUTER

CEF440: INTERNET PROGRAMMING AND MOBILE PROGRAMMING

DESIGN AND IMPLEMENTATION OF A MOBILE APPLICATION FOR ARCHIVAL AND RETRIEVAL OF MISSING OBJECTS UTILIZING IMAGE MATCHING TECHNIQUES: REQUIREMENT GATHERING

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1. INTRODUCTION

Losing track of belongings is a common human experience. Keys vanish into thin air, wallets mysteriously disappear, and cherished keepsakes seem to walk away on their own. Traditional methods of recovering lost items often leave us feeling frustrated and defeated. Posters plastered around town blend into the background noise, lost and found centres offer limited reach, and relying on detailed descriptions can be unreliable.

This highlights the need for a more efficient and reliable solution in the digital age. With the ever-growing trend of digitization, a digital approach seems like a natural fit to address the problem of lost objects.

This project proposes the design and implementation of a mobile application specifically for the archival and retrieval of missing objects. This innovative app will leverage the power of image matching techniques to bridge the gap between lost items and their rightful owners. By harnessing the potential of digital technology, we aim to significantly improve the success rate of recovering lost belongings, transforming a frustrating experience into a positive one.

The strategic focus on requirement gathering for this project is paramount. Understanding the nuanced needs and pain points of users is crucial in shaping the functionality and usability of the mobile application. Through meticulous requirement analysis and stakeholder engagement, the project seeks to deliver a robust solution that not only enhances retrieval efficiency but also integrates seamlessly into the daily lives of its users. This introductory document sets the stage for a comprehensive exploration of user-centric design principles and technological innovation in the pursuit of simplifying the quest for lost objects in today's digital landscape.

2. STAKEHOLDERS

A stakeholder is any individual or group with an interest in a project or organization. Their interest could be financial, operational, or even social. They are typically involved in the day-to-day operations and decision-making processes.

With respect to our project, we have two types of stakeholders namely internal and external. Internal stakeholders have a direct relationship with the project and are invested in its success.

2.1 Internal Stakeholders

- Project Team: This includes developers, designers, user experience (UX) specialists, and project managers responsible for building and launching the application.

2.2 External Stakeholders

- End Users: These are individuals who will be using the mobile application to archive and retrieve missing objects.

3. REQUIREMENT GATHERING TECHNIQUES

This section of the document outlines the requirements for the designing and implementation of a mobile application for the archival and retrieval of missing objects utilizing image matching techniques. The requirements have been gathered through a combination of methods: interviews, surveys, brainstorming sessions, and research.

3.1 Interviews

This summarizes the key requirements gathered through interviews. The users emphasized on data security, user-friendliness, efficient retrieval, image capture with descriptions, lost document location assistance, a reward system for finders, just to name a few.

After interviewing 34 people of age range 18 to 45, physical documents emerged as a key concern for 80% of the interviewees. Many participants highlighted the frequent misplacement of documents compared to other belongings, emphasizing their strong interest in a mobile app that aids in document retrieval.
The following unpacks further user requirements gotten from the interviews.

- User Needs and Pain Points:
  - Ease of Use: Users emphasized the need for a user-friendly interface that is accessible to people of all technical backgrounds (intuitive).
  - Image Capture and Description: While some users prefer image capture (camera upload), others value the option to add detailed descriptions for accurate identification.
  - Data Security: A critical concern is ensuring the security of sensitive documents. Users expressed a strong desire to prevent accidental broadcasts. (Sensitive documents should not be broadcast)
  - Lost Document Retrieval: In case of lost documents, users want functionalities to help locate them. This could include:
    - Finder Localization: Identifying the location of the finder (if enabled by the finder). (Localisation of the finder)
    - Contacting the Finder: A secure in-app communication channel to connect with the finder. (Has to contact the finder)

- Reward System: From the interview, the interviewees revealed a strong support to reward the finders to motivate them. The interview data revealed strong user support for an incentive system that rewards finders (e.g., through gift cards).

➢ User Experience (UX) Considerations:

- Feedback Mechanism: Users want a feedback mechanism to report issues and suggest improvements. (Feedback for end users)
- App Reviews: Analysing reviews of existing document management apps can provide valuable insights into user preferences and potential shortcomings. (Review from existing Apps)

➢ Document Management Features:

- Selective Sharing: The ability to control which documents can be shared with specific individuals. (Controlling which documents can be shared)
- Organization System: A clear and intuitive organization system for storing and retrieving documents was requested. (File organization system).
- Backup Functionality: The app should offer a secure backup option to prevent data loss in case of device malfunction. (Backup functionality)

➢ Other Features:

- XML Parsing: Some users expressed interest in an optional feature that parses XML data within documents to facilitate identification. (Repibe xml to identify the content)
- Advanced Search: Users requested robust search functionalities based on:
    - Document name keywords
    - Description content
    - Text recognition capability within the image itself (potentially using Optical Character Recognition - OCR) (Search by name and description & Read the content of the image to identify missing objects)

The interviews revealed a clear need for a secure and user-friendly mobile application for managing important documents. Users prioritize data security, ease of use, and efficient retrieval functionalities. The ability to add descriptions alongside image capture provides flexibility for users with

varying preferences. The optional features like XML parsing and advanced search cater to users with more complex document management needs.

3.2 Survey

This section summarizes the findings from a survey conducted to understand user experiences and preferences regarding lost items and potential solutions.

➢ Survey Demographics

- A total of 49 individuals participated in the survey.
- No demographic information was collected to maintain participant anonymity.

➢ Frequency of Losing Items

- Nearly half of respondents (41.2%) reported losing personal belongings occasionally (a few times a year).
- 47.1% reported losing items rarely (once a year or less).
- A combined 11.7% lose items frequently (once a month or more) or very frequently (multiple times a month).

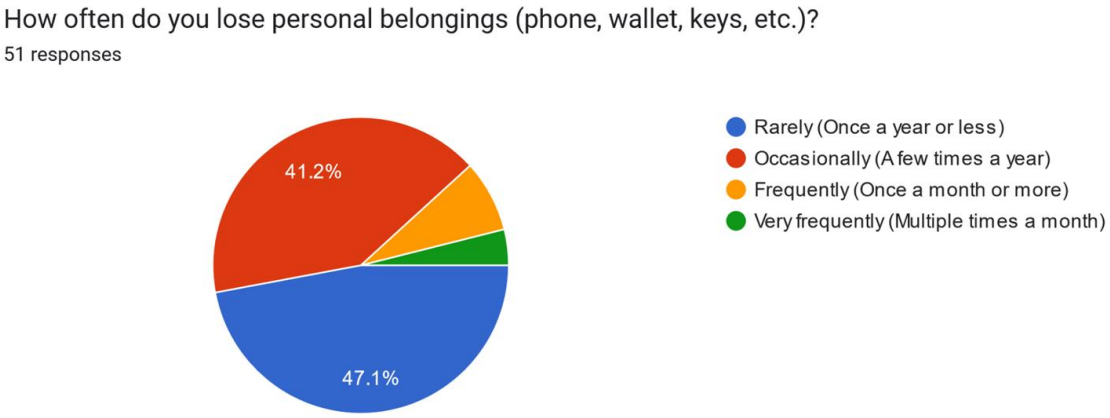

Figure 1: Statistics of how often belongings get missing from the results of the survey

➢ Common Lost Items

The most commonly lost items, as reported by respondents (with selection frequency as a percentage of total responses):

- Phone (28.6%)

- Wallet/Purse (22.4%)
- Keys (38.8%)
- Documents (ID, passport, etc.) (42.9%)
- Electronics (laptops, tablets) (16.3%)

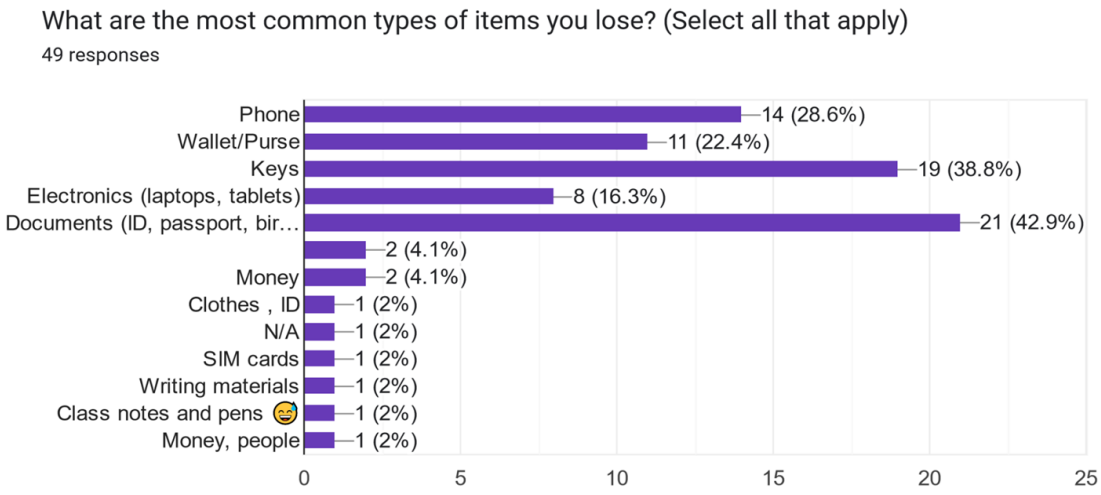

Figure 2: Statistics of objects that commonly get missing from the survey

➢ Current Recovery Methods

When searching for lost items, users rely on a variety of methods (with selection frequency as a percentage of total responses):

- Posting online (social media, lost and found platforms) (67.3%)
- Offering a reward (16.3%)
- Looking for the item in familiar locations (6.1%)
- Informing close friends and family (6.1%)
- Retracing steps (2.0%)

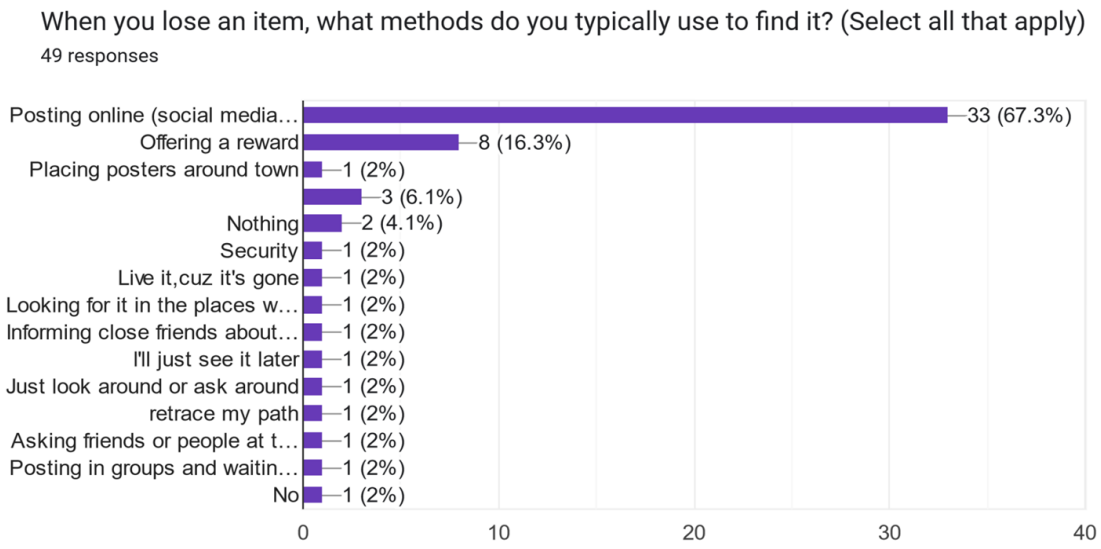

Figure 3: Revealing statistics of use of other methods to find lost items from the survey

- Satisfaction with Current Methods

  The majority of respondents (42.9%) expressed dissatisfaction with existing methods for finding lost items. Only 10.2% were very satisfied.

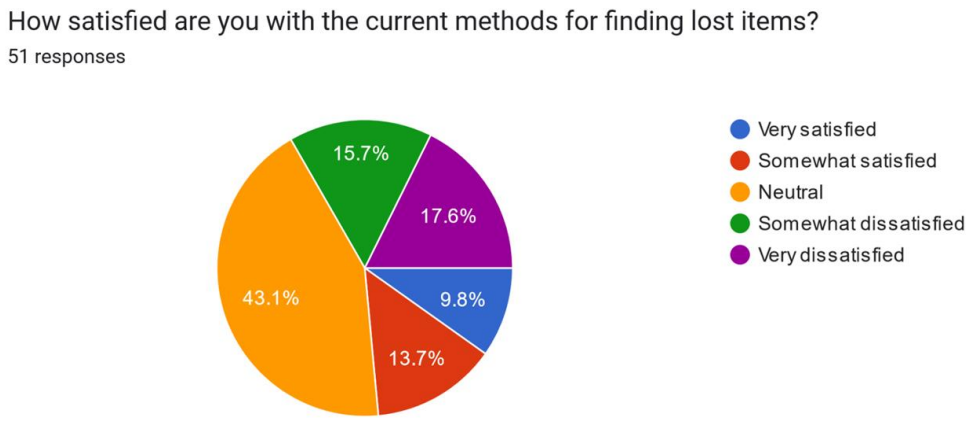

Figure 4: Statistics of satisfaction of current methods for finding lost documents

- Challenges During Item Searches

Open-ended responses revealed several key frustrations users experience when searching for lost items:

- Uncertainty about the item's location
- Difficulty in retracing steps
- Lack of efficient search tools
- Time wasted searching

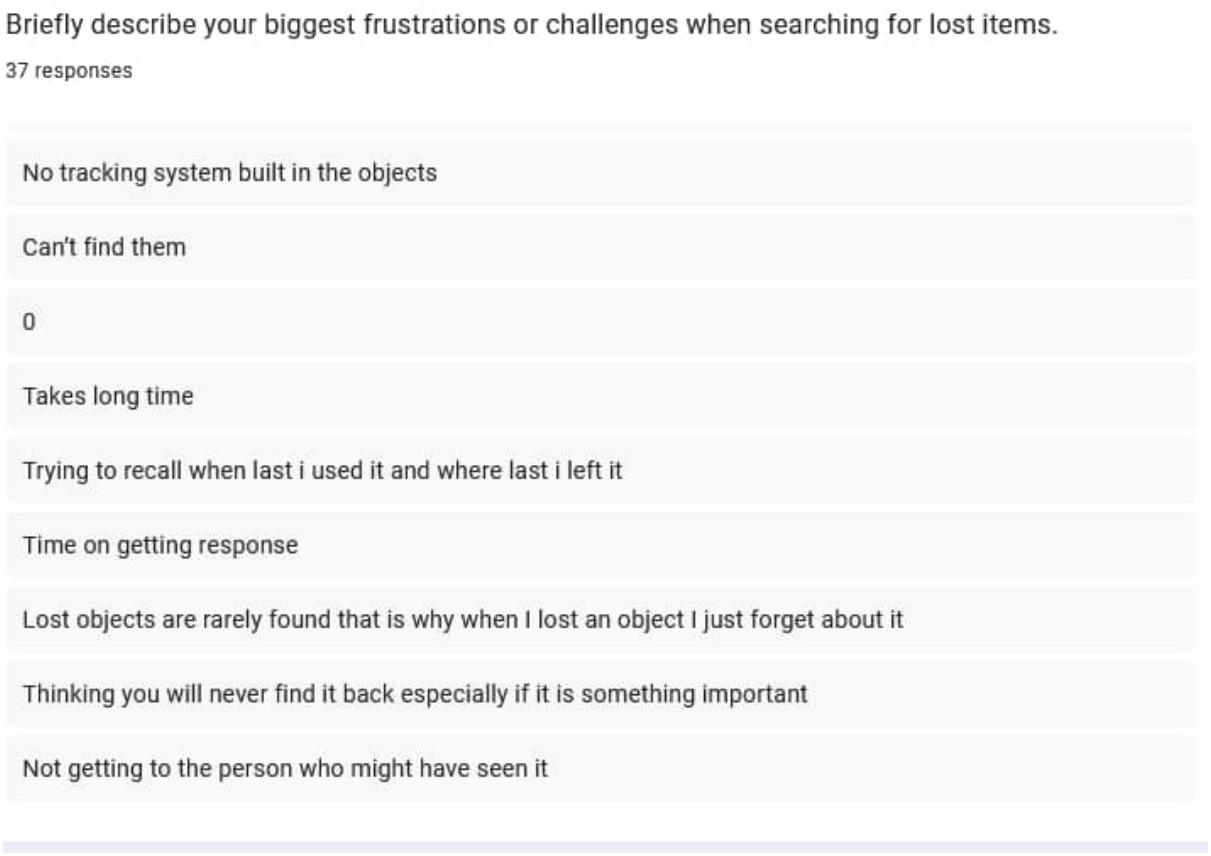

Figure 5: *Biggest challenges experienced using other methods of finding lost documents from the survey*

➢ Interest in a Lost Item Retrieval App

A significant majority of respondents (90%) indicated they would be likely or very likely to use a mobile app designed for lost item retrieval.

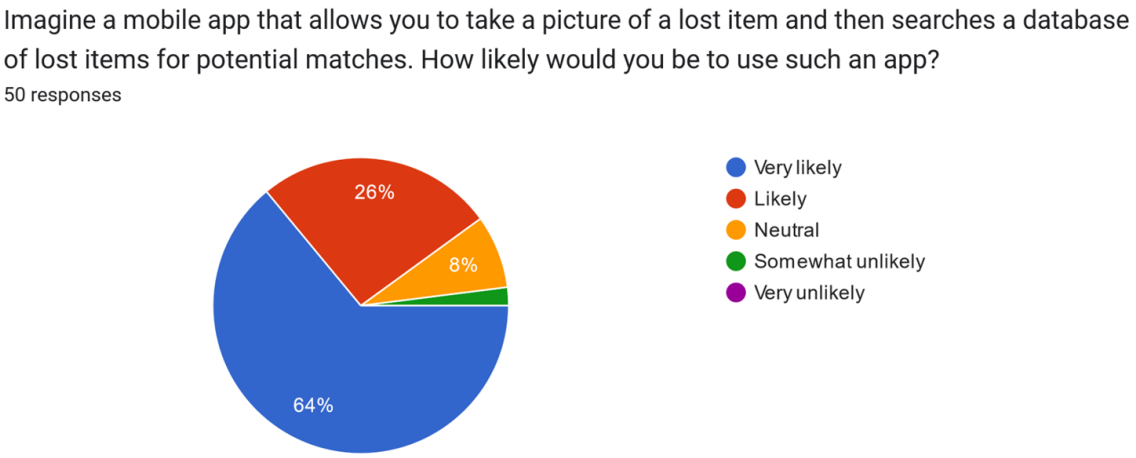

Figure 6: Statistics of respondents about having a mobile app for retrieval and archival of missing objects

➢ Desired App Features

The most desired features as indicated by respondents (with selection frequency as a percentage of total responses):

- Secure storage of lost item information (54%)
- Easy and quick image capture (66%)
- Advanced image recognition for accurate matching (56%)
- Location-based search functionality (54%)
- Ability to connect with finders (64%)
- Integration with other social media platforms (46%)
- Reporting lost items (42%)
- Notification alerts for potential matches (61.2%)

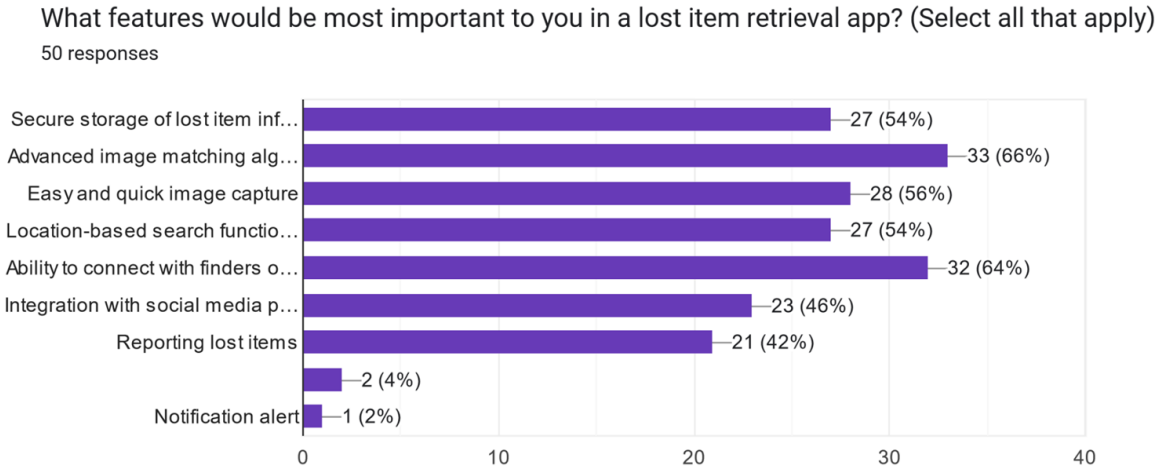

Figure 7: Revealing potential features of the app as gotten from the survey

- Additional User Input

Several respondents emphasized the importance of data security and user privacy. Others suggested features like integration with social media for wider reach and the ability to report lost items within the app.

The results of the survey indicates a clear need for a more efficient and user-friendly solution for lost item retrieval.
The desired features prioritize secure data storage, accurate search capabilities, and user-friendly functionalities for reporting and connecting with potential finders.

3.3 Brainstorming

This section reveals the results of a brainstorming session conducted with the project team. The goal was to explore functionalities and features from a development perspective, focusing on technical feasibility and implementation strategies.

Brainstorming Session
Our internal development team participated in a brainstorming session to generate ideas and solutions for the mobile application.
Focus on Development Considerations

While user needs are an ultimate target, this sessions focused on functionalities and features that can be implemented within the project. The brainstorming explored various aspects, including:

- Integration of image recognition libraries and algorithms.
- User interface design and user experience optimization for efficient interaction.
- Data storage and security considerations for document information and user data.

The following sections detail the key ideas generated during the brainstorming session, categorized by functionalities within the application.

- Key Findings:

- Inter-App Communication and Sharing:

    - The possibility of integrating the app with other applications for document sharing was discussed. However, security and privacy concerns require further investigation before implementation.
- User Communication:
    - The previously proposed secure in-app chat function was confirmed as a valuable feature for users to communicate with each other regarding lost documents.
- User Notifications and Tracking:
    - The team reaffirmed the importance of sending users notifications when their uploaded document potentially matches an entry in the app's database.
    - Additional functionalities were explored, such as allowing users to keep track of who found their lost documents (requires careful consideration of user privacy).
- User Customization:
    - The ability for users to personalize the app's interface through features like theme selection was again confirmed as a desirable feature.
- Location Tracking:
    - The use of a location tracking technology was revisited. While it can be valuable for recording the last known location of a document, privacy concerns and potential battery drain need to be addressed.
- Content Recognition:
    - The limitations of OCR technology in accurately extracting text from all document types were acknowledged. While it remains a valuable tool, alternative methods for content identification (e.g., document type classification).
- Performance Optimization:
    - The importance of selecting an efficient image matching algorithm to achieve fast response times for document searches was emphasized.
    - Techniques to improve the quality of user-uploaded images, particularly low-quality ones, were discussed as a way to enhance image recognition accuracy.

3.4 Research

This report summarizes research conducted to explore functionalities and features for a mobile application designed to facilitate the retrieval of lost documents using image matching technology. The research aimed to gather insights similar to those obtainable through a user survey, focusing on user needs and pain points related to lost documents.

Research Findings

The research yielded valuable information about user needs and expectations for a lost document retrieval mobile application. Here's a breakdown of the key findings:

- User Pain Points:
  - Difficulty in locating misplaced documents.
  - Time wasted searching for lost documents.
  - Frustration with traditional methods of lost and found reporting.
  - Concerns about identity theft if lost documents contain sensitive information.
- Desired Functionalities:

- Secure storage of digital copies of important documents.
- Easy and efficient search functionality using keywords or image recognition.
- Ability to report lost documents and receive alerts if a potential match is found.
- Secure communication channels with individuals who may have found lost documents.
- Importance of data privacy and security for uploaded documents.
- Potential integration with existing cloud storage services for document management.
- User-friendly interface with clear instructions and easy navigation.
- Accessibility features for users with visual impairments or other disabilities.
- Data security:

  Security measures are crucial to ensure the privacy and security of user data, especially images of lost objects that may contain sensitive information. Encryption and secure storage practices are essential.
- A location tracking feature can be implemented to record the last known location where a document was accessed or scanned. Users can also view location history (if applicable) and receive alerts if a document's location changes significantly.

- Scalability: The application should be designed to accommodate a growing user base and data volume. Cloud-based solutions can provide scalability and reliability.

- Deep learning: Convolutional Neural Networks (CNNs) are a powerful approach achieving high accuracy in image recognition tasks. However, their computational demands may be a challenge for mobile app development.

➢ Existing Mobile Applications

- Ajouza Mobile App, known as Ajuoza, serves as a platform for locating both your lost loved ones and crucial documents. It also offers features that allows you to verify if your important documents have been found and are available at local police stations. The app utilizes detailed descriptions to facilitate searches. Upon encountering a missing document uploaded on the platform, users are prompted to provide additional identification to ensure their rightful ownership.

- About other existing applications

    - Functionalities are often limited to text-based search and reporting.
    - Some applications allow users to upload photos of lost objects, but image recognition capabilities are rare.

4. CONCLUSION

The requirement gathering process revealed a strong demand for a mobile application that utilizes image recognition to enhance lost item retrieval, with a particular focus on important documents.

Through various methods, this process successfully identified user needs and pain points, highlighting the challenges associated with finding misplaced documents. The research also emphasized the importance of data security and privacy for sensitive information.

This valuable information will guide the design and development of the mobile application, with the ultimate goal of creating a user-centric solution that streamlines object retrieval in the digital age.

5. REFERENCES

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