Methodology Implementation For IPR Protection Of Mobile Application Code Using Digital Watermarking

Himanshu Rastogi, Dr. Birendra Kumar Sharma

Abstract: Today, there is hardly anyone who does not have a mobile phone. It is a common practice for everyone to have a mobile phone, because humans are using mobile phones effectively. If a mobile phone is not there, a human being today cannot complete its work even. Viewed from the right perspective, mobile phone is an unprecedented invention by man and for man. But everyone knows that whatever is beneficial to human beings in this earth is also harmed by the same thing. People are using mobile phone for Easy Communication, Connect with Social Media, Success device in Business, For personal security. All over the world the growth of internet is increasing and so theft of software code is also major concern. It becomes the severe issue for the developer of the software code, because they invest time and money for the development of software code. The security of mobile application code is necessary. Lots of protection techniques have been designed and developed to secure these codes from unauthorized accessibility. This research paper is presented as the implementation procedure of the Digital Watermarking Technique, described by Himanshu et al. [3], to secure Intellectual Property Right of the mobile application code. The implementation is done using Android Studio 2.2.3 and Java programming language.


1. INTRODUCTION
We are living in the age of information where billions of bits of data is created in every fraction of a second and with the advent of internet, creation and release of digital data, which could be in either form like images, video and audio files, digital repositories and libraries, etc has grown many fold. Since copying a digital data is very easy and fast too so, issues like, protection of rights of the content and proving ownership, arises [10]. Large numbers of mobile applications are running over the network due to Internet facility is increasing day by day. Everyone is using these mobile applications either for entertainment or to improve the efficiency and effectiveness of their business work by reducing cost, provide fastest accessibility and secure transaction etc. The developer of the code wants to protect this code from unauthorized access. This code could be accessed by any unauthorized user by entering into the system. Protection of such software code is necessary. The vast popularity of the World Wide Web (www) in the early 1990’s demonstrated the commercial potential of offering multimedia resources through the digital networks. Since commercial benefits look for the use of digital networks to offer digital media for profit, they have a strong interest in protecting their ownership rights. Digital watermarking has been projected as one way to accomplish this. Intellectual Property (IP) is described as any "original creative work manifested in a tangible form that can be legally protected”. Intellectual Property rights, means to control the method IP is used, accessed or distributed. The IP laws were enforced throughout the world by World Intellectual Property Organization (WIPO). With the help of protecting IP, we want to promote creativity and encourage the creator.

1.1 IPR Protection
"Intellectual Property” is any music, literary work, art, discovery, symbol, name, picture, design, copyright, trademark, patent, etc. created by a person or entity. Just as one is the owner of physical wealth, one can also be the owner of intellectual property. Intellectual property rights are provided for the protection of IP. One can control the use of his intellectual property and use it to create material wealth to explore and innovate. Intellectual property may include the following products:

1.1.1 Patent
For the protection of new ideas and creativity from being unauthorized used, patents are used. For this creativity, creature spends lots of money and time for its research and development and so the creature wants to deliver this product or creativity only to the authorized user. In case of Software Program, four categories can be considered for the Intellectual Property (IP): Functionality of Program, Graphical User Interface, Program Coding, and External Design.

1.1.2 Trademark
In order to identification of goods and services provided by a company from another, Trademarks are used. Trademark is a type of graphical signature, which could be the combination images, text, slogan, color combination. Names and logos of computer programs can be trademarked. The trademark registration for software-based names and logos is valid for 10 years; after this period the registrant must prove that the trademark is still in use, what allows to renew the registration for the next 10 years. There is no maximum lifetime limit for the trademark – it can be renewed indefinitely [9].

1.1.3 Copyright
Copyright is a form of intellectual property. It gives the author exclusive rights to the publication, distribution and adaptation of an original work for a fixed time period. If someone write a good story, or compose a song, or do a painting, it will be a description of something. That person or owner will have

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copyright in it. If owner publish it, no one else can use it without his permission. Copyright is the most common form of protection used in computer science. All software is copyright protected, except material placed in the public domain. Computer programs are automatically subject to a copyright, and if the author would like to put the software to the public domain, he must explicitly disclaim the copyright. Public domain means that there is completely no ownership, as copyright, trademark, or patent [9].

1.2 Digital Watermarking

Digital watermarking is the process of embedding any information or security code within a digital file without noticeably altering the file itself. At present digital watermarking is increasing attention due to the fast developing in the internet traffic. Digital watermarking achieved is popularity due to its significance in content authentication and copyright protection for digital multimedia data. It is inserted invisible in host image so that it can be extracted at later times for the evidence of rightful ownership [12]. A cryptographic key in the form of security key is used during in both the process i.e. Embedding Process and Extraction Process. The purpose using this security key is to stop the actual content or value from unauthorized use [5].

1.2.1 Embedding Process

Actual Value is the original content, which to be watermarked. Watermarked Value is the outcome of the Embedding Process, which is obtained by the insertion of security key in actual value, as shown in the Fig.-1.

![Fig-1: Digital Watermarking Embedding Process](image1)

1.2.2 Extraction Process

Watermarked Value and Security key are used as input for Embedding Process. After extraction process, data received will be the Actual value, which will be same as inserted during Embedding Process. Extraction process is shown in Fig. 2.

![Fig-2: Digital Watermarking Extraction Process](image2)

1.3 Mobile Applications

Nowadays almost all the people are using mobile phone, whether cheap or expensive, small or big. Anyone can easily take the mobile phone anywhere. Mobile phones can be used as long as the network is coming on mobile phone. It has been a common practice to use mobile phone. In absence of mobile phone most of the people cannot complete their work, which is either related to their business, education, or entertainment. Using a simple smartphone, user can easily take photos, enjoy songs or videos, send emails, play games with the help of internet. Mobile phone has to be very beneficial in the field of business too. Owner of the company or CEO can easily contact company’s employees and get all the information. All work related information can also be explained and sent over the phone to the concern employees. Managers, sitting anywhere, can deal with companies sitting in distant countries and complete all the meetings through video calls. This will also make it easier to know about your business and will also give a boost in business. Many criminal activities are happening these days. The location of any mobile phone can be tracked from the computer via GPS in the mobile phone. The police has also easily stopped many legal activities from the records of all the phone numbers or messages in the mobile phone.

![Fig-3: Information Flow of Mobile Application](image3)

An information flow of mobile application is as shown in the Fig-3. As shown in the figure, the message is sent by the user mobile phone to the mobile service provider using data net or wi-fi technology. This message will be redirected to the web server, which then forwarded to the mobile app framework, for e.g. PHP (and database, if required), PHP will the send this message to the concern website. The required page, as response will be sent back to web server with the help of PHP. Web server sends this information to user’s mobile through mobile service provider.

2 LITERATURE REVIEW

H. Rastogi et al [3] proposed a method of embedding an encrypted key in the original data. In this research paper, the technique of cryptography was implemented with an assigned key and also explained the working procedure of the technique. Kaur et al [7] proposed a new method for the protection of digital contents using digital image watermarking. In this proposed method author, presented a technique using a combination of spatial domain technique and frequency domain techniques. Tejas R. Bhongale et al [2] have done a survey on Tools and Technologies Applicable for Mobile Application Development. In their research paper they discussed about the tools used to Develop Mobile App, various Technologies used to design and develop Smart App, Advantages and Limitations of Android Technology L. Ashwin Kumar [11] described the novel designing and implementation
details of a mobile app supporting news access and virtual community interactive services. This work was based on few open technologies like Java programming language, Android and Android libraries, MySQL database and an open Web server. During their work, the main objective was to create an easy to use, mobile, interactive, flexible, along with a portable Android client and a Web portal access to the content. Papageorgiou et al [1] provide an in-depth security and privacy analysis of the popular freeware mobile health applications. In their work they performed both static and dynamic analysis of selected mobile applications, including tailored testing of each application's functionalities. Some unique features of the present paper are long term analyses of the life cycle of the reviewed apps and general data protection regulation compliance auditing procedure. Yuvraj Sharma et al [4] worked on the usage pattern of mobile apps and their impact on day to day activities of people. In their research they collected data from 150 respondents a well structured pre-tested questionnaire. They analyze the study by statistical test using SPSS and it was applied to explain the factor needed to identify and analyze the relationship between different mobile applications and user engagement. Result analysis interpreted that the appearance of Smartphone and increase use of mobile applications plays an important role to enhance user engagement towards the mobile apps. So, the security and privacy of Mobile app is necessary.N. Ajit Kumar et al [6] suggested that some deficits are remaining in the development criterions and implementation of the best policies which signify the mobile device for some probable attacks. Such deficiencies are required to be analyzed carefully and additional effort is required. Their study capitalizes in the direction of better understanding of the current mobile application development processes, along with the inspection of actual issues and challenges and explores the best and perfect practices that can be effectively applied and implemented to the mobile app development process. Dan Johansson et al [8] have pointed out a broad spectrum of ongoing research and innovation activities within the area of mobile e-services he discussed about the several factors like technological advancements and increased availability of new tools and emergent technologies available in a mobile. Another important factor is the willingness and preparedness from service providers to invest in new technology and new innovative solutions. A third important factor is the motivation from end-users actually using the new types of e-services delivered.

3 DIGITAL WATERMARKING ALGORITHM

3.1 Embedding Algorithm: Following is the proposed algorithm for embedding code was described by H.Rastogi et al [3]. In this algorithm, Actual Value string will be first encrypted by using some algorithm. This encrypted text will then combine with a secret key. Combination of these two values will then processed by embedding function to form a watermarked text character string. This Watermarked Value can be displayed on the mobile app at any place. The representation of algorithm is shown in the Fig. (4).

3.2 Extraction Algorithm: This algorithm is the reversible process of the algorithm used in embedded code. In this algorithm, Watermarked Value will be split on the basis of the last two character code of the Watermarked Value. These two character code will be converted in to number system form to find the length of Actual Value string. Let say it is ‘n’. After that, first ‘n’ characters of the Watermarked Value will be split and decrypt with the same key as used in the embedding algorithm. If it is matched with Actual Value / Original Value, then the ownership is authenticated otherwise it is rejected. The representation of algorithm is shown in the Fig. (5).

<table>
<thead>
<tr>
<th>Algorithm for Extraction</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Input:</strong> Watermarked Value.</td>
</tr>
<tr>
<td><strong>Output:</strong> Actual Value.</td>
</tr>
<tr>
<td><strong>Step 1:</strong> Start</td>
</tr>
<tr>
<td><strong>Step 2:</strong> Read Watermarked Value</td>
</tr>
<tr>
<td><strong>Step 3:</strong> Extract Last two characters to find out the length of the Actual Value.</td>
</tr>
<tr>
<td><strong>Step 4:</strong> Encrypt these last two characters i.e. convert into numeric value; say it is ‘n’</td>
</tr>
<tr>
<td><strong>Step 5:</strong> Extract First ‘n’ characters from Watermarked Value.</td>
</tr>
<tr>
<td><strong>Step 6:</strong> Decrypt these extracted values, which will be Extracted Actual Value.</td>
</tr>
<tr>
<td><strong>Step 7:</strong> Check for authenticity:</td>
</tr>
<tr>
<td>if Extracted Actual Value = Actual Value then Ownership Accepted</td>
</tr>
<tr>
<td>Else</td>
</tr>
<tr>
<td>Rejected</td>
</tr>
<tr>
<td><strong>Step 8:</strong> Stop.</td>
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</tbody>
</table>

4 METHODOLOGY IMPLEMENTATION ON MOBILE APPLICATION CODE

The above Algorithms have been implemented in Android Studio 2.2.3. Nexus 5 API 24 was used as Android Virtual Device (AVD) and Java programming Language. For the implementation of the algorithm, functions for Embedding and Extraction are defined in MainActivty.java file.
Function definition and their calling used in MainActivity.java file:

```java
public class MainActivity extends AppCompatActivity {
    protected String EncryptionCode(String strActualValue) {
        //coding to encrypt actual string
        //coding to generate random char
        //coding to append two char for length
    }

    protected String ExtractionCode(String strEncryptValue) {
        //coding to extract length of original string & encrypted string
        //coding to convert into original string
    }

    protected void onCreate(Bundle savedInstanceState) {
        btnEncryption.setOnClickListener(new View.OnClickListener() {
            public void onClick(View view) {
                //Function Calling for Encryption Code
                String strEncValue = EncryptionCode(strActualValue);
            }
        });

        btnExtraction.setOnClickListener(new View.OnClickListener() {
            public void onClick(View view) {
                //Function Calling for ExtractionCode
                String strExtValue = ExtractionCode(strEncValue);
            }
        });
    }
}
```

5 CONCLUSION

Mobile application plays a major role for Easy Communication, Connect with Social Media, Success device in Business, For personal security etc. In this research paper our concern is to implement the proposed model of Digital Watermarking for the protection of IPR of mobile application code. For the protection of software code, different research papers were surveyed. We have implemented the same model in Android Studio 2.2.3. Nexus 5 API 24 was used as Android Virtual Device (AVD) and Java programming Language. In this research paper, we have discussed about the algorithm and also the steps involved in using the model.

REFERENCES