

# SMSENCRYPTION PROJECT REQUIREMENTS SPECIFICATION

**COS730 - Group 1**

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# 1 History

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## **3 Introduction**

### **3.1 Purpose**

This document describes the software requirements and specifications for the SMSEncryption mobile application.

The document will be used to ensure requirements are well understood by all stakeholders. It is therefore intended for all stakeholders of the project; including the developers and customers.

### **3.2 Background**

Reliable communication using newer generation cellular technologies, such as GSM or 3G, is not always possible in certain parts of South Africa, as the signal for these technologies are either non-existent, or intermittent.

Therefore, communication normally occurs using SMS technology, which is generally not very secure. Messages sent via SMS are generally encrypted with a weak and broken stream cipher, and can thus be read by any competent attacker who intercepts the SMS. SMS messages are also stored on an SMSC for up to 15 days, which can then be viewed by an unknown party. This can cause a loss in confidentiality, integrity and availability of the communicators.

There is a need to develop a secure way of communicating using conventional mediums such as SMSes.

### **3.3 Scope**

The goal of this project is to create a mobile application which can be used to encrypt text before sending it via SMS technology, which can be decrypted on the receiving end. The application must be able to be used on more than one platform (i.e. iOS and Android).

By using the SMSEncryption application, the user will be able to encrypt messages which can only be decrypted by using the same application on the

receiving end. The application will require local authentication in order to gain access to the application and make use of its features.

The benefit of this application is that you can use SMS technology to send confidential messages which can only be viewed by you and the desired recipient of the message - who is the only party who can unencrypt the message.

### 3.4 Definitions, acronyms and abbreviations

- **SMSEncryption** - The name of the current project which will allow users to encrypt and decrypt text with the main purpose of it being sent as an SMS, or via other messaging applications such as WhatsApp, WeChat, Facebook chat etc.
- **Message** - The text intended to be sent from a sender to a receiver or stored once said message has been encrypted via SMSEncryption.
- **Plaintext** - Is information a sender wishes to transmit to a receiver.
- **Ciphertext** - Is the result of encryption performed on plaintext using an algorithm, called a cipher.
- **Encrypt** - To alter the plaintext using an algorithm so as to be unintelligible to unauthorized parties.
- **Decrypt** - The act of decoding a ciphertext back into the original form before conversion took place.
- **User** - An authorised person who will interact with the application.
- **Sender** - The person who authored and intends to send a message that has been encrypted via the application.
- **Receiver** - The intended party who receives a message which has been encrypted via the application.
- **SMS** - Short Message Service (SMS) is a text messaging service component of phone, Web, or mobile communication systems. This allows for short messages to be sent to other devices over a network which is not controlled by the sender or receiver.
- **SMSC** - Short Message Service Centre (SMSC) is a network element in the mobile telephone network. Its purpose is to store, forward, convert and deliver SMS messages.

- GSM - Global System for Mobile Communications (GSM) is a second generation standard for protocols used on mobile devices.
- Entropy - The expected value of the information contained in a message.

### 3.5 Document Conventions

- Documentation formulation: LaTeX
- Naming convention: Crows Foot Notation

### 3.6 References

- Kyle Riley - MWR Info Security
  - face-to-face meeting
  - email
- Bernard Wagner - MWR Info Security
  - face-to-face meeting
  - email

### 3.7 Overview

The rest of the document will be organized to include the following sections: General Description and Specific Requirements for the SMSEncryption application.

The General Description section will provide a background to the reader for the SMSEncryption application, and contains the following sections: Product Perspective, Product Functions, User Characteristics, Constraints and Assumptions and Dependencies.

The Specific Requirements section contains requirements for the SMSEncryption application, and is organised by application features. This is done in such a way that it will highlight the functions of the application.



The sections contained in Specific Requirements include External Interface Requirements, System Features, Performance Requirements, Design Constraints, Software System Attributes, and Other Requirements.

## 4 General description

### 4.1 Product perspective

#### 4.1.1 Description

SMSEncryption is a new product which can be used in conjunction with any mobile text manipulation application, such as the general keyboard input used by the different mobile operating systems, or any other text manipulating application, capable of using the basic GSM character set - should you require encryption and decryption functionality for secure communication between two parties.

The GSM character set contains a limited amount of characters, which will, in turn, limit the encryption methods we can make use of, as many encryption algorithms greatly increase both the size of the message, and the number of different characters used. Making use of these encryption algorithms that generate large amounts of characters will be infeasible, as sending large SMSes will be expensive.

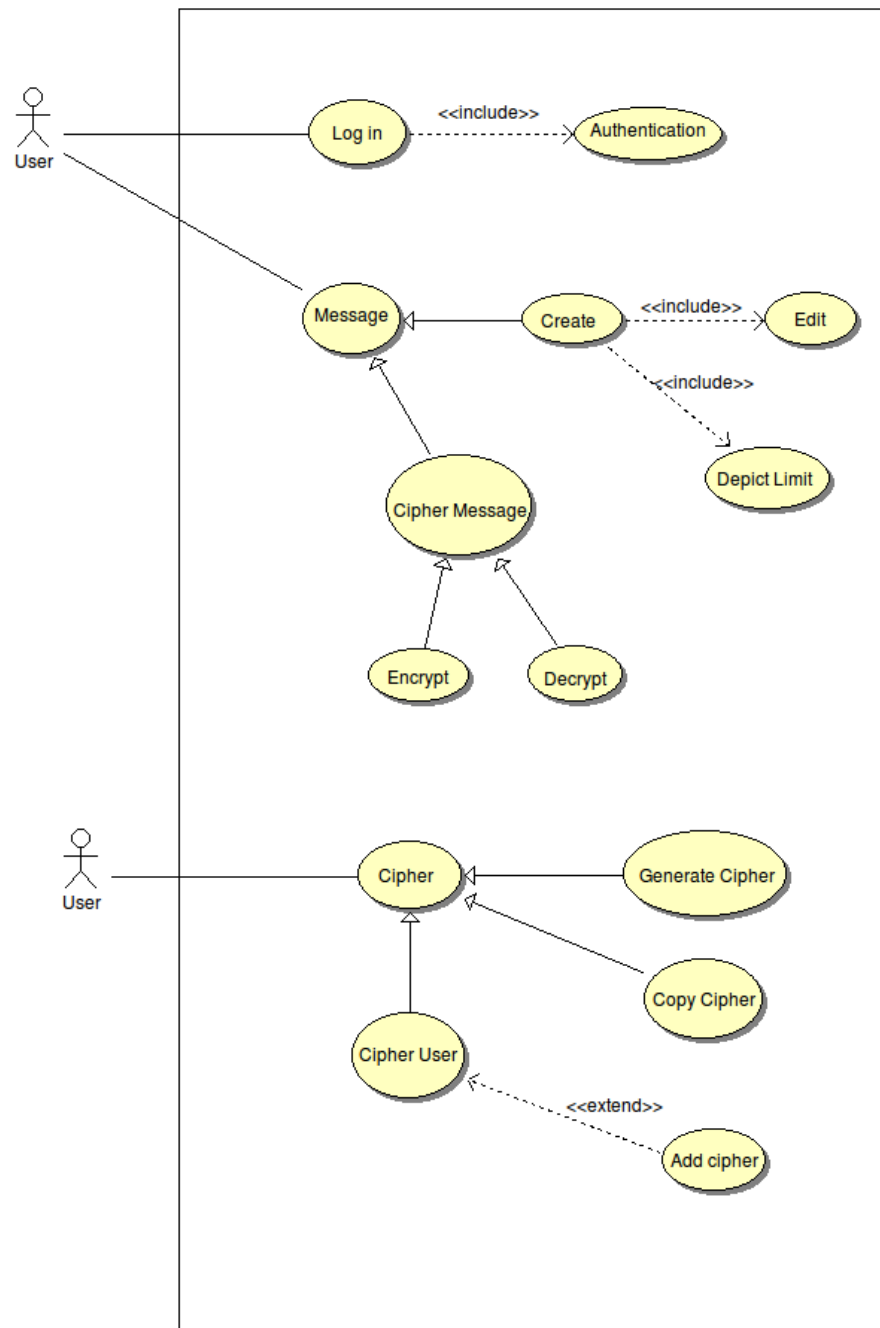
Software interface - The software interface will make use of operating system features, such as a clipboard on the device to facilitate 'copying' and 'pasting' of texts or ciphertexts.

User interface - The user interface is what will allow the user to type a message, encrypt it, copy the ciphertext, and paste it into the application that will send the message. On the receiving end, the message received will be copied, and pasted into the SMSEncryption application, which will be used to decrypt the received message. This ensures integrity of the message, as only users of the application will be able to encrypt/decrypt the message in the agreed upon way.

Hardware Interface - The software will run on a mobile device that allows user interaction and text manipulation.

#### 4.1.2 Use Cases

SMSEncryption Use case diagram



## **4.2 Product features**

### **4.2.1 Log In**

- On first use of the application, a password must be created that will ensure user authentication.
- Every time a user wants to use the application, the password must be provided along with the login details.
- If the provided password (and related details) are entered correctly, the user may gain access to the application.
- If the password provided remains incorrect after a specified number of times, the application will lock for a specified time - preventing access from an unauthorised user.

### **4.2.2 Message**

#### **Create**

- The plaintext is created independently by the user and input into the application.
- The plaintext can also be created and edited within the application.

#### **Cipher Message**

- The user will select a relevant contact, that contacts details will then be used to perform encryption or decryption.
- The message will be encrypted to obtain the cipher text, which the user can then copy out and paste into the application that will send the ciphertext to the desired receiver; via any messaging method.
- The desired receiver will be able to decrypt the message back into its plaintext.

### **4.2.3 Device Synchronization**

- In order for communication to take place between two devices they need to be synchronized.
- A user adds what is called a contact, it will ask the name of the contact as well as generate a unique word to be provided to the other person and an input box where the unique word appearing on the contacts phone.
- Both users must add each other at the same time, because they need each other unique word that will be generated for their communication. This will synchronize communication between the devices.

### **4.3 User characteristics**

- There will be only one user class who will have full access to all the features provided by the application after local authentication.
- It is assumed that the user has proficient knowledge on how to copy items from messages such as SMS and paste it within this application.
- It is also assumed that the users performed the device synchronization phase correctly as there is no way for the device to know.

### **4.4 Constraints**

- The application must make use of the basic GSM character set.

### **4.5 Assumptions and dependencies**

- It is assumed that the amount of characters in the basic GSM character set is 128 for the 7-bit encoding used in GSM.
- It is assumed that the devices being used allows for copy and pasting of text between different interfaces and applicaitons.

## 5 Specific requirements

## **5.1 External Interface Requirements - Hein and Henko input**

### **5.1.1 User interfaces**

### **5.1.2 Hardware interfaces**

### **5.1.3 Software interfaces**

### **5.1.4 Communications interfaces**

## **5.2 Product Functions**

### **5.2.1 Create message : FRQ1**

**(Source: Bernard Wagner, Priority: High)**

- A message must be able to be typed in the application.
- The message must be editable.

### **5.2.2 Encrypt message : FRQ2**

**(Source: Bernard Wagner, Priority: High)**

- The message must be encrypted using a suitable encryption method.
- The user must be able to select and copy the message to the clipboard in order to be sent using the method the user wants to.

### **5.2.3 Local Authentication : FRQ3**

**(Source: Bernard Wagner, Priority: High)**

- The application must use a password to log on in order to ensure confidentiality.



## **5.3 Performance Requirements**

- The application should operate in a timely manner, the user should not be made to wait an unreasonable amount of time (this variable can be affected by the system environment e.g. resource availability).
- The encryption method must be secure.

## **5.4 Design constraints**

### **5.4.1 Message length : DC1**

**(Source: Bernard Wagner, Priority: High)**

- Due to the fact that the primary messaging service which the client intends to use is SMS this limits the input size of the text to 160 characters. To maintain consistency we enforce this as the maximum length of messages which the application can encrypt and decrypt.

### **5.4.2 The usable characters : DC2**

**(Source: Bernard Wagner, Priority: High)**

- The usable character which can be encrypted by the application is the GSM character set because the primary intended messaging service that the client wishes to use is SMS.

### **5.4.3 Application resource requirementsr : DC3**

**(Source: Bernard Wagner, Priority: High)**

- The application should function efficiently with the least amount of resource usage.

## **5.5 Software system attributes**

### **5.5.1 Reliability**

- The application should run until the user closes it.
- Any information stored in the application should be static and exist as long as the application is open or said information is removed/edited.
- The Cypher text should decrypt into its plaintext.

### **5.5.2 Availability**

- The user should be able to use the application as long as it is running and should not be made to wait while the application performs a function.
- The application should not interfere with any other applications which are running on the device.

### **5.5.3 Security**

- A secure encryption and decryption method with entropy of no more than one percent will have to be used.

### **5.5.4 Maintainability**

- The source code should be maintainable (simplistic and readable/documented).
- The application should not act in unpredictable ways.

### **5.5.5 Portability**

- The client has requested that different versions of the application be developed to execute on different operating systems namely Android and IOS.

## **6 Appendix A - RSA**

### **Introduction**

This appendix is about research done in pursuit of a possible solution to the given problem. It is about RSA and how we researched possible RSA solutions to encrypt an SMS message.

### **Method**

We started by trying to use the build in RSA implementation that is built into Java. After that we did research into the background of RSA, more specifically the maths that make it work. We then attempted numerous combinations of the mathematical principals behind RSA to see if any of them could manage to be used to fulfill the needed requirements.

### **Result**

The build in RSA used keys that would become too large to redistribute, in order to accommodate encrypted text of as close as possible to 160 characters after padding required a 700 bit key. It also limited the amount of characters to about 77 characters before it became larger than 160 characters.

We implemented a custom RSA but it started out week due to the limits imposed by our character set. We looked into an alternative where 2 encrypted characters represented 1 plain text character. This gave some strength to the encryption but limited the message one could send to 80 characters. The client said that this was not an option.

### **Discussion**

When thinking about modern encryption we think about RSA and how useful it is, the thing we easily forget is behind the scenes large amounts of data is transferred just to enable the encryption and decryption. It is because of the keys being too large to SMS that the build in RSA was disregarded,

along with uncontrolled padding in an environment where message length was extremely important. In our custom RSA we could control the length of the key but just like the build in version it limited characters too much.

## Conclusion

RSA works well in modern technologies but it only works well where we can transfer large amounts of data relatively easily such as for example data transfer over the internet. We need large keys to make the encryption strong due to the limitations of the character set, but with no way of distributing the key and the limitations to the key length RSA is not the answer to this problem.

## References

- Kaliski, B., n.d. The Mathematics of the RSA Public-Key Cryptosystem. s.l.:RSA Laboratories.

## **7 Appendix B - One time pads**

### **Introduction**

This is about research done into one time pads, an encryption technique that if used correctly is unbreakable. It also provides the person attempting to decrypt the message with no information about the plaintext apart from the max possible length it could be.

### **Method**

We did some research into one time pads and why it is that they are so strong. After that we implemented a onetime pad algorithm and it looked very promising.

### **Result**

The encryption is very strong, allows for 1 to 1 character encryption thus enabling us to have a plain text message of 160 characters fully utilizing space. It seemed to be the solution to the problem.

### **Discussion**

The first thing that comes to mind when thinking about one time pad encryption is how to distribute the pad. The pad needs to be distributed between the two parties and they must at any given moment in time know what the next line that will be used will be, in other words it requires synchronization.

### **Conclusion**

In terms of message length and encryption strength it is perfect but with no way of distributing the one time pad securely we had to disregard this solution.

## References

- Electronic, M., n.d. One Time Pad Encryption, The unbreakable encryption method. s.l.:mils electronic gesmbh & cökg.

## 8 Appendix C - Protocol

### Diagrams

Work flow diagram

### Description

## 9 Appendix Y - Secure design principles

As specified by the OWASP mobile security project the following are the most prevalent mobile threats as of 2014 which are applicable to the SMSEncryption project.

### **- Insecure Data Storage**

The security of data the application stores is of the utmost importance as it could store the public and private keys of users or the OTP . Therefor we must consider threats to the data which is stored by the application.

### **- Unintended Data Leakage**

Data leakage is a viable threat which demonstrates the lack of control developers have when developing on mobile applications , for instance the OS which you are developing for will handle memory management , this can be exploited by would be attackers by looking for unprotected areas in memory.

### **- Poor Authorization and Authentication**

Poor Authorization and authentication is relative to this project as we have to consider the consequences of the application being accessed and used by unauthorized personnel.

### **- Broken Cryptography**

We have to ensure that we make use of a suitable encryption method so that it can not be easily decrypted by attackers and that it does not require a disproportionate amount of resources to implements or use.



## **- Lack of Binary Protections**

This is a universal problem as almost all code which is compiled into binaries will be able to be reverse engineered into some form of discernable source code.

## 10 Appendix Z - Design Principles

### Introduction

This sections contains the design principles available for Android and iOS developers. As the goal is to make SMSEncryption for both these platforms both sets of principles need due consideration.

### Android

The android design principles were developed with user experience in mind and are as follows:

- Enchant Me
  - Delight me in surprising ways
    - \* A beautiful surface, a carefully-placed animation, or a well-timed sound effect is a joy to experience. Subtle effects contribute to a feeling of effortlessness and a sense that a powerful force is at hand.
  - Real objects are more fun than buttons and menus
    - \* Allow people to directly touch and manipulate objects in your app. It reduces the cognitive effort needed to perform a task while making it more emotionally satisfying.
  - Let me make it mine
    - \* People love to add personal touches because it helps them feel at home and in control. Provide sensible, beautiful defaults, but also consider fun, optional customizations that don't hinder primary tasks.
  - Get to know me
    - \* Learn peoples' preferences over time. Rather than asking them to make the same choices over and over, place previous choices within easy reach.
- Simplify My Life

- Keep it brief
  - \* Use short phrases with simple words. People are likely to skip sentences if they're long. Pictures are faster than words. Consider using pictures to explain ideas. They get people's attention and can be much more efficient than words.
- Decide for me but let me have the final say
  - \* Take your best guess and act rather than asking first. Too many choices and decisions make people unhappy. Just in case you get it wrong, allow for 'undo'.
- Only show what I need when I need it
  - \* People get overwhelmed when they see too much at once. Break tasks and information into small, digestible chunks. Hide options that aren't essential at the moment, and teach people as they go.
- I should always know where I am
  - \* Give people confidence that they know their way around. Make places in your app look distinct and use transitions to show relationships among screens. Provide feedback on tasks in progress.
- Never lose my stuff
  - \* Save what people took time to create and let them access it from anywhere. Remember settings, personal touches, and creations across phones, tablets, and computers. It makes upgrading the easiest thing in the world.
- If it looks the same, it should act the same
  - \* Help people discern functional differences by making them visually distinct rather than subtle. Avoid modes, which are places that look similar but act differently on the same input.
- Only interrupt me if it's important
  - \* Like a good personal assistant, shield people from unimportant minutiae. People want to stay focused, and unless it's critical and time-sensitive, an interruption can be taxing and frustrating.
- Make Me Amazing
  - Give me tricks that work everywhere

- \* People feel great when they figure things out for themselves. Make your app easier to learn by leveraging visual patterns and muscle memory from other Android apps. For example, the swipe gesture may be a good navigational shortcut.
- It's not my fault
  - \* Be gentle in how you prompt people to make corrections. They want to feel smart when they use your app. If something goes wrong, give clear recovery instructions but spare them the technical details. If you can fix it behind the scenes, even better.
- Sprinkle encouragement
  - \* Break complex tasks into smaller steps that can be easily accomplished. Give feedback on actions, even if it's just a subtle glow.
- Do the heavy lifting for me
  - \* Make novices feel like experts by enabling them to do things they never thought they could. For example, shortcuts that combine multiple photo effects can make amateur photographs look amazing in only a few steps.
- Make important things fast
  - \* Not all actions are equal. Decide what's most important in your app and make it easy to find and fast to use, like the shutter button in a camera, or the pause button in a music player.

## iOS