A Minor Project Synopsis on

**Analysis of standard elliptic curves for the implementation of ECC Cipher in resource-constrained environments**

Submitted to Manipal University, Jaipur

Towards the partial fulfillment for the Award of the Degree of

**BACHELOR OF TECHNOLOGY**

In Computers Science and Engineering

2018-2022

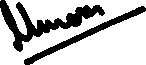
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**Introduction:**

Nowadays, many publicly observable Internet protocols

offer cipher suites that contain elliptic curve based

cryptographic algorithms. Today, ECC is increasingly used

to implement public-key cryptography protocols, such as

digital signatures and key agreement protocols. Bitcoin,

secure shell (SSH), Transport Layer Security (TLS), and the

Austrian e-ID card is some of the application protocols

which make use of ECC in the real world [1]. Many E-

commerce applications also use elliptic curve cryptography,

due to its security features.

There are many international standards available for the

selection of elliptic curves. The choice of the curve is

dependent on the security requirement and the required

efficiency of the curve in terms of computation speed. In [2]

the first release of cryptographic standards specifying elliptic

curves for use in practice is given for the different key sizes.

The standards that recommend curves for various security

levels are defined over either prime or binary extension fields.

Currently, across the internet, the elliptic curves deployed are

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size [4]. The advantages of using smaller elliptic groups are

smaller key sizes, bandwidth savings, and faster

implementations which are useful for safety implementation

in resource-constrained applications. So, while implementing

ECC cryptosystem in the field of E-commerce it is important

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**Motivation:**

In the current digital world and public-key cryptography segment, the majority of deployments are fulfilled by the RSA based cryptosystems. Cryptosystems based on elliptic curves emerge as an alternative to the RSA cryptosystems. The security of the RSA cryptosystem is based on the integer factorization problem (IFP) whereas the security of ECC is based on the elliptic curve discrete logarithm problem (ECDLP). The significant attraction towards ECC is that the best-known algorithm for solving the ECDLP takes full exponential time while for solving IFP of RSA takes sub exponential time. ECC takes less memory than RSA and is better than RSA, especially on memory-constrained devices. Moreover, ECC provides same level of security as the RSA but with reduced key size.

**Project Objective:**

All of the different international standards available today

focus on the selection of safe and efficient elliptic curves for

implementing ECC. Each standard of curve strives to

maintain the difficulty of the Elliptic Curve Discrete

Logarithm Problem (ECDLP). For the sake of efficiency,

each standard has a particular form of the elliptic curve along

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**-Pros:**

1. ECC is faster as compared to RSA. Moreover, it provides same level of security with small size key. For example, a 160-bit ECC encryption key provides the same security as a 1024-bit RSA encryption key and can be up to 15 times faster, depending on the platform on which it is implemented.
2. The advantages of ECC over RSA are particularly important in wireless devices, where computing power, memory and battery life are limited.

**-Cons:**

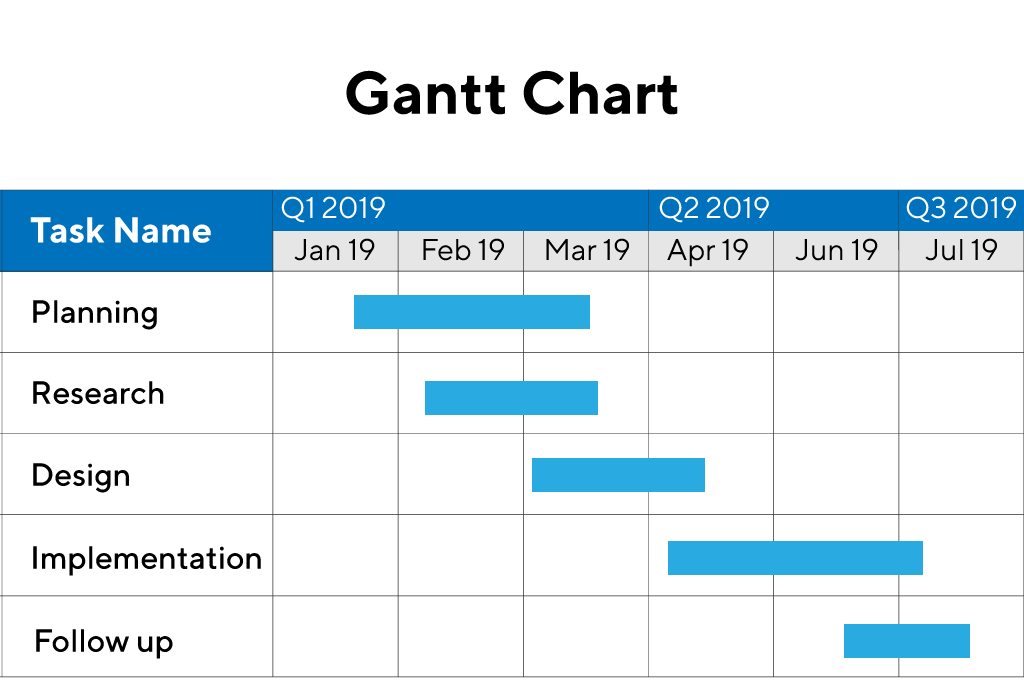
1. One of the main disadvantages of ECC is that it increases the size of the encrypted message significantly more than RSA encryption.
2. the ECC algorithm is more complex and more difficult to implement than RSA, which increases the likelihood of implementation errors, thereby reducing the security of the algorithm.

**METHODOLOGY:**

The analysis will be performed by considering each curve for the implementation of the Elliptic Curve Diffie-Hellman (ECDH) algorithm and the Elliptic Curve Digital Signature Algorithm (ECDSA). **The analysis is carried out using SageMath, which is a free open-source mathematics software system licensed under the GPL, using Python 3.**

**PLANNING:**

**FEB’21 MARCH’21 APRIL’21 MAY’21**



**FACILITIES REQUIRED for PROPOSED WORK:**

* SOFTWARE
  + Windows 10
  + Python 3.x
* HARDWARE
  + HDD/SSD with sufficient storage capacity
  + Core i5 Processor
  + At least 4GB RAM

**BIBLIOGRAPHY:**

1. J. R. Shaikh, M. Nenova, G. Iliev and Z. Valkova-Jarvis, "Analysis of standard elliptic curves for the implementation of elliptic curve cryptography in resource-constrained E-commerce applications," 2017 IEEE International Conference on Microwaves, Antennas, Communications and Electronic Systems (COMCAS), Tel-Aviv, Israel, 2017, pp. 1-4, doi: 10.1109/COMCAS.2017.8244805.