

# *A Way to Secure a QR Code: SQR*

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**Abstract**—Now a day, need for fast accessing of data is increasing with the exponential increase in the security field. QR codes have served as a useful tool for fast and convenient sharing of data. But with increased usage of QR Codes have become vulnerable to attacks such as phishing, pharming, manipulation and exploitation. These security flaws could pose a danger to an average user. In this paper we have proposed a way, called Secured QR (SQR) to fix all these issues. In this approach we secure a QR code with the help of a key in generator side and the same key is used to get the original information at scanner side. We have used AES algorithm for this purpose. SQR approach is applicable when we want to share/use sensitive information in the organization such as sharing of profile details, exchange of payment information, business cards, generation of electronic tickets etc.

**Keywords**—QR-Code; SQR; AES; Encryption; Decryption; Password;

## I. INTRODUCTION

The world has seen a considerable measure of changes in the domain of correspondence. Today we no more utilize land-lines. Everybody has a cell phone that capacities 24X7. Our handsets not just keep us associated with the world everywhere yet additionally fill the need of amusement contraption. From 1G to 2.5G and from 3G to 5G this universe of broadcast communications has seen various changes alongside enhanced execution with each passing day. The fifth era is visualized to be a total system for remote versatile web, which has the capacity to offer administrations for obliging the application potential necessities without misery the quality. A definitive objective of 5G is to plan a genuine remote world, that is free from hindrances of the prior ages. 5G innovation will change the way in which cell designs are offered around the world. Another transformation is going to start. The worldwide wireless is around the bend.

5G advances would change the way most high-transfer speed clients get to their telephones. With 5G pushed over a VOIP-empowered gadget, individuals will encounter a level of call volume and information transmission never experienced before. 5G innovation is putting forth the administrations in Product Engineering, Documentation, supporting electronic exchanges (e-Payments, e-exchanges) and so forth. As the client turns out to be increasingly mindful of the cell phone innovation, he or she will search for a not too bad bundle all together, including all the propelled highlights a mobile phone can have. Consequently the look for new innova-

tion is dependably the fundamental rationale of the main wireless monsters to out improve their rivals.

5G innovation has a splendid future since it can deal with best advances and offer invaluable handset to their clients. May be in coming days 5G innovation assumes control over the world market. 5G Technologies have a phenomenal ability to help Software and Consultancy. The Router and switch innovation utilized as a part of 5G arrange giving high availability. The 5G innovation circulates web access to hubs inside the building and can be conveyed with association of wired or remote system associations. The present pattern of 5G innovation has a gleaming future.

## II. EVOLUTION FROM 1G TO 5G

### 1. 1G

It is the original innovation that exists in 1980's and it takes a shot at simple signs. It bolsters furthermore, information band width in kbps. Simple cell phone system(AMPS) was first settled in USA in versatile systems. The original of simple cell phones has accelerate to 2.4 Kbps. It permits end clients to make voice calls just inside 1 nation. It depends on fundamental versatility.

Drawbacks:

- It is a poor voice quality.
- Hand off unwavering quality.
- Large sizes of telephones.
- No security system.
- Poor bearer conglomeration.
- Band width per frequency channel of 1G is up to 30Khz.

### 2. 2G

It was presented in 1990. The innovations based on GSM. It is basically utilized for versatile correspondence and furthermore utilizing for the SMS and email. It is utilizing two regulation strategies. The regulation strategy are time division multiple access(TDMA) and code division multiple access (CDMA). In the innovation holds productive security for the sender and

collector. Recurrence data transmission of channel up to 200Khz. The center system is PSTN.

Drawbacks:

- No quality of services.
- The maximum speed is up to 64Kbps.
- Cannot take multiple parties simultaneously.

### 3. 3G

The 3G innovation was presented in 2000. The 3G administrations join fast versatile access with Internet Protocol (IP) based administrations. It is likewise called as tri band 3G. The most extreme information exchange speed is up to 3.1mbps. It offers high information rate up to 2Mbps. It gives quicker correspondence, expansive broadband abilities, video conferencing, 3D gaming, fast web, greater security. It gives computerized route. The transmission capacity per frequency channel is up to 20 Mhz. the center system is parcel organize. The various get to strategy is code division multiple access (CDMA).

Drawbacks:

- The cost of cellular infrastructure, upgrading base stations is very high.
- Power consumption is high.
- Roaming and data/voice work together has not yet been implemented.
- Requires closer base stations and are expensive.

### 4. 4G

The 4G innovation was launched in Tokyo, Japan on June 23rd 2005. The 4G gives dynamic data access and wearable gadgets. The information data transmission rate is 1Gbps. The 3G as of late is institutionalizing LTE Advanced as future standard. 4G give top notch spilling and extra highlights, for example, sight and sound daily paper and ultra wide band web get to this procedure not present in 3G. The various get to strategy is code division multiple access method (CDMA). The data transfer capacity per frequency channel is up to 100 MHz The center system is web. The 4G innovation is WI-FI. The speed of 4G is additionally expanded to stay aware of information get to request utilized by different administrations.

Drawbacks:

- New frequency means new components in cell tower.
- Higher Data Price for consumers.
- Less coverage in crowded environment.
- Less reliable and responsive, real-time connections.

### 5. 5G

The next generation telecom networks (5G) will hit the market by 2020. 5G is expected to unleash a massive IoT ecosystem where networks can serve communication needs for billions of connected devices, with the right trade-offs between speed, latency and cost. 5G is something beyond speedier cell phone downloads, be that as it may, as the innovation could likewise be the way to making a more quick witted, more associated world. 5G systems are the up and coming age of versatile web network, offering quicker speeds and more dependable associations on cell phones and different gadgets than at any other time. 5G is relied upon to give significantly quicker download and transfer speeds than 4G systems, taking into account speedier gushing and downloading.

Table 1: Evolution from 1G to 5G

<b>Technology</b>	<b>1G</b>	<b>2G</b>	<b>3G</b>	<b>4G</b>	<b>5G</b>
<b>Start /Deployment</b>	1970-80	1990-2004	2004-10	Now	Soon (probably by 2020)
<b>Data Bandwidth</b>	2Kbps	64 Kbps	2 Mbps	1 Gbps	Higher than 1Gbps
<b>Technology</b>	Analog	Digital	CDMA 2000, UMTS, EDGE	Wi-Max, Wi-Fi, LTE	WWWW
<b>Core Network</b>	PSTN	PSTN	Packet N/W	Internet	Internet
<b>Multi-plexing</b>	FDMA	TDMA/CDMA	CDMA	CDMA	CDMA
<b>Switching</b>	Circuit	Circuit, Packet	Packet	All Packet	All Packet
<b>Primary Service</b>	Analog Phone Calls	Digital Phone Calls and Messaging	Phone calls, Messaging, Data	All-IP Service (including Voice Messages)	High speed, High capacity and provide large broadcasting of data in Gbps

<b>Key Differentiator</b>	Mobility	Secure, Mass adoption	Better Internet experience	Faster Broadband Internet, Lower Latency	Better coverage and no dropped calls, much lower latency, Better performance
<b>Weakness</b>	Poor spectral efficiency, major security issue	Limited data rates, difficult to support demand for internet and e-mail	Real performance fail to match type, failure of WAP for internet access	Battery use is more, Required complicated and expensive hardware	?

### III. KEY CHARACTERISTICS

- Real wireless world with no more limitation with access and zone issues.
- Wearable devices with AI (Artificial Intelligence) capabilities.
- Internet protocol version 6 (IPv6), where a visiting care-of mobile IP address is assigned according to location and connected network.
- One unified global standard.
- Dynamic Ad hoc Wireless Networks (DAWN), essentially identical to Mobile ad hoc network (MANET), Wireless mesh network (WMN) or wireless grids, combined with smart antennas, cooperative diversity and flexible modulation.
- User centric (or cell phone developer initiated) network concept instead of operator-initiated (as in 1G) or system developer initiated (as in 2G, 3G and 4G) standards.
- World Wide wireless web (WWW), i.e. comprehensive wireless-based web applications that include full multimedia capability beyond 4G speeds.
- Group cooperative relay: A major issue in beyond 4G systems is to make the high bit rates available in a larger portion of the cell, especially to users in an exposed position in between several base stations. In current research, this issue is addressed by cellular repeaters and macro-diversity techniques, also known as group cooperative relay, as well as by beam division multiple access (BDMA).
- Pervasive networks providing ubiquitous computing: The user can simultaneously be connected to several wireless access technologies and seamlessly move

between. These access technologies can be a 2.5G, 3G, 4G or 5G mobile networks, Wi-Fi, WPAN or any other future access technology. In 5G, the concept may be further developed into multiple concurrent data transfer paths.

- Cognitive radio technology, also known as smart-radio: allowing Different radio technologies to share the same spectrum efficiently by Adaptively finding unused spectrum and adapting the transmission scheme to the requirements of the technologies currently sharing the spectrum. This dynamic radio resource management is achieved in a distributed fashion, and relies on software defined radio.
- High altitude stratospheric platform station (HAPS) systems.

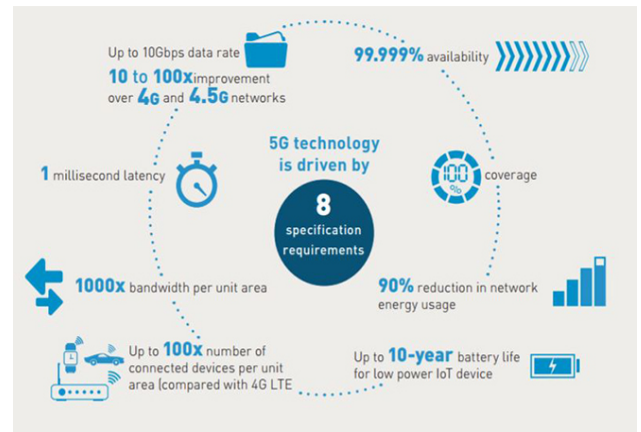


Figure 1: 5G Characteristics

### IV. MAJOR APPLICATION AREAS

One of the principle advantages of 5G innovation more than 4G won't be its speed of conveyance – which could be in the vicinity of 100Gbps – however the latency. At present, 4G is equipped for in the vicinity of 60ms, which is low-latency however insufficient to give constant reaction. Multiplayer gaming, for instance, requires a lower latency than that to guarantee that when you hit a catch, the remote server reacts in a flash.

5G's forthcoming ultra-low-latency could extend in the vicinity of 10ms. This would permit, for instance, an onlooker in a football stadium to watch a live stream of an elective camera edge of the activity that matches what is happening the pitch ahead with no noticeable deferral. The limit is a vital factor as well. With the Internet of Things ending up increasingly vital after some time, where contraptions and items utilize keen, associated highlights that they have never had, the strain on transmission capacity will keep on growing. That is the reason 5G is required, to give a large number of new associations with web associated tech.

### 1. High Speed Networks

5G will reform the versatile involvement with super-charged remote system, which can bolster up to 10 to 20 GBPS of information download speed. It is identical to a fiber optic Internet accessed remotely. Contrasted with regular portable transmission advancements, voice and fast information can be transferred productively at the same time in 5G. Versatile downloads will be significantly quicker, dependably on, constantly associated and responsive portable Internet offer power portable experience. 5G systems will empower secure access to distributed storage; access of big business applications, run intense undertakings with more prominent preparing power essentially.

Wi-Fi offloading and gadget to-gadget correspondence procedures are recommended to additionally upgrade arrange execution and support amid constrained access or non-attendance of portable systems. Little cell idea utilized as a part of 5G will have different focal points of better cell scope, most extreme information exchange; low power utilization and cloud get to organize and so on....

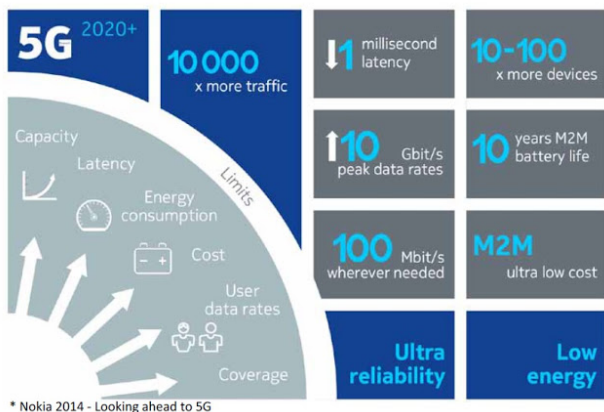


Figure 2: 5G Performance Targets

### 2. Entertainment and Multimedia

Examiners found that 55 percent of versatile Internet activity has been utilized for video downloads all inclusive in 2015. This pattern will increment in future and top quality video spilling will be basic in future. 5G will offer a superior quality virtual world on your cell phone. Rapid streaming of 4K recordings just takes few moments and it can bolster completely clear sound lucidity.

5G can give 120 frames for each second, high determination and higher dynamic range video gushing without interference. Varying media experience will be changed after the usage of most recent advances controlled by 5G

remote. Augmented reality and virtual reality requires HD video with low latency. 5G organize is sufficiently effective to control AR and VR with astounding virtual experience. HD virtual reality recreations are getting famous and numerous organizations are contributing on VR based gaming. Rapid 5G system can offer better gaming knowledge with fast Internet.

### 3. The Internet of Things: the device explosion

By the year 2020, it is anticipated by examiners that every individual in the UK will possess and utilize 27 web associated gadgets. There will be 50 billion associated gadgets around the world. These can run from existing innovation, for example, cell phones, tablets and smartwatches, to ice chests, autos, enlarged reality specs and even brilliant garments. A portion of these will require huge information to be moved forward and backward, while others may very well need little parcels of data sent and got. The 5G framework itself will comprehend and perceive this and dispense transmission capacity separately, in this manner not putting superfluous strain on singular access points.

#### i. Smart Home

Keen home machines and items are getting up to speed the market today. Keen home idea will use 5G systems for gadget availability and checking of uses. 5G remote system will be used by savvy machines which can be arranged and gotten to from remote areas, shut circuit cameras will give top notch constant video for security purposes.

#### ii. Logistics and shipping

Logistics and shipping industry can make utilization of keen 5G innovation for products following, armada administration, unified database administration, staff planning and constant conveyance following and detailing.

#### iii. Smart City

Shrewd city application like activity administration, Instant climate refresh, neighborhood, vitality administration, savvy control framework, brilliant lighting of road, water asset administration, swarm administration, crisis reaction and so forth.... can utilize dependable 5G remote system for its working.

#### iv. Industrial IoT

Future businesses will rely upon keen remote advances like 5G and LTE progressed for proficient mechanization of hardware, prescient upkeep, well-being, process following, brilliant pressing, delivery coordination and vitality administration. Keen sensor innovation offers boundless answers for mechanical IoT for quicker witted, safe, financially savvy and vitality effective modern activity.

#### v. *Smart Farming*

5G innovation will be utilized for horticulture and brilliant cultivating in future. Utilizing brilliant RFID sensors and GPS innovation, ranchers can track area of domesticated animals and oversee them effortlessly. Brilliant sensors can be utilized for water system control, get to control and vitality administration.

#### vi. *Fleet Management*

Numerous organizations are utilizing shrewd GPS beacons for armada administration, 5G innovation will give much better answers for area following and armada administration.

#### vii. *Healthcare and mission critical applications*

5G innovation will bolster therapeutic experts to perform propelled medicinal methodology with dependable remote system associated with another side of the globe. Associated classrooms will assist understudies with attending courses and essential instructors. Individuals with constant restorative conditions will profit by shrewd gadgets and ongoing observing. Specialists can interface with patients from anyplace whenever and guide them when essential. Researchers are chipping away at savvy therapeutic gadgets which can perform remote medical procedure.

#### viii. *Autonomous Driving*

Self-driving autos are not exceptionally a long way from reality with the utilization of 5G remote systems. Elite remote system availability with low idleness is critical for self-governing driving. In future, autos can speak with brilliant activity signs, encompassing articles and different vehicles out and about. Each millisecond is imperative for self-driving vehicles, choice must be made in part second to keep away from crash and ensure traveler wellbeing.

#### ix. *Drone Operation*

Automatons are getting prominent for numerous activities extend from amusement, video catching, restorative and crisis get to, shrewd conveyance ar-

rangements, security and observation and so on. 5G system will furnish solid help with rapid remote web availability for ramble task in extensive variety of uses. Amid crisis circumstances like regular disasters, people have restricted access to numerous regions where automatons can connect and gather valuable data.

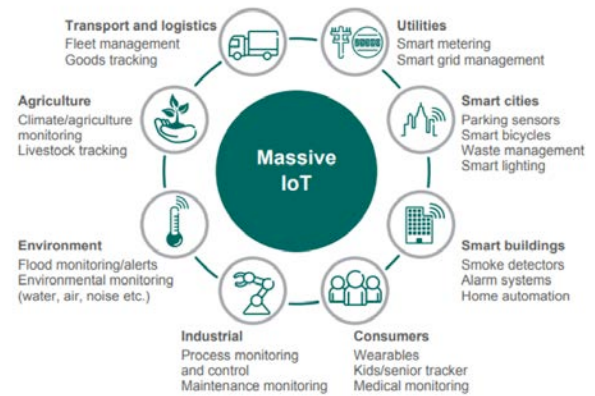


Figure 3: 5G and IoT

#### 4. *Mobile Broadband*

Numerous other information concentrated applications – both buyer situated and business-to-business – are additionally very nearly rising. Illustrations incorporate virtual and expanded reality, 3D and ultra-HD video and haptic criticism applications. While it has been conceivable to adapt so far to rising information request (and the business has been cunning in managing this through activity streamlining and offload on to different systems for example), unmistakably new limit should be made through utilization of new range and major changes to some center remote advancements, and development in the system. Note that remote advances can regularly more rapidly convey high-speed Internet availability to populaces as of now un-served or underserved by wire line foundation; if the financial aspects of future 5G systems can bolster it, remote will turn into the true methods for Internet access for huge quantities of individuals around the world – in creating and created markets.

#### 5. *Energy and Utilities*

5G could help give the essential help to basic Machine Type Communication (MTC) applications for vitality network checking what's more, control and bolster the huge volume of MTC write applications rising up out of expanded utilization of keen metering. As indicated by

the 5G-IA: "the foreseen execution and adaptability of 5G will empower a correspondence foundation which can bolster the rising vitality utilize cases... the progressing advancement of the power network into a framework supporting a significantly more disseminated age and capacity of energy and in addition smaller scale matrices would be an unmistakable recipient of the superior, yet at the same time extremely adaptable correspondence engineering gave by 5G.

## V. CHALLENGES

Challenges are the inborn piece of the new improvement; along these lines, similar to all innovations, 5G has additionally enormous difficulties to manage. As we see past i.e. improvement of radio innovation, we find quick development. Beginning from 1G to 5G, the adventure is simply of around 40 years of age (Considering 1G out of 1980s and 5G out of 2020s). Notwithstanding, in this adventure, the normal difficulties that we watched are absence of framework, examine philosophy, and cost.

### 1. *Increase in Number of Connections*

The Internet of Things (IoT) will make a monstrous increment in the quantity of gadgets and associations crosswise over remote systems. Billions of gadgets are probably going to be associated with the systems. These gadgets will make new requests in the aggregate volume of information and dealing with the physical number of associations. In current 3GPP-based systems, there are control plane points of confinement on the quantity of clients that can be associated, and booking cutoff points to quantities of clients transmitting or accepting on particular system hubs, and this confine is probably not going to be adequate to deal with the development of the IoT. Consequently new planning and access control instruments will be required, and in addition decreasing the measure of control plane motioning for IoT clients.

### 2. *Huge Data Volumes*

The volume of information (50 billion associated gadgets by 2020) is a key for the advancement of 5G innovations. The measure of information being gone ahead portable systems is developing at pace of in excess of 25 percent a year and this is relied upon to proceed in next ten years, not as a result of the applications that require higher information rates yet in addition as a result of expanded screen determination and advancements in 3D video. Additionally, now voice isn't a committed circuit exchanged

administration yet an application likewise utilizing parcel information network. So we see the test of information limit at last to-end arrange should be expanded, and this is the air interface as well as the entire access/center system. As new innovation develops then bottlenecks in the framework may change, thus new information bottlenecks should be overcome.

### 3. *Speedy and flexible deployment*

Speed of implementation of 3G and 4G was confined by the speed at which appropriate backhaul arrange limit could be given to each new site, and the limit/adaptability of the backhaul. 5G will be tested to additionally create CRAN as another development in arrange configuration, supplementing the client and control plane partition in the move towards more adaptable cloud based systems. In this idea, a few elements of the RAN are moved from the cell site once again into a combined baseband cloud benefit. This gives an answer for help scaling what's more, economy, prompting arrangement adaptability and less demanding reconfiguration, in light of the fact that the center flagging and knowledge is held inside the cloud and the main restricted physical components are the RF handsets to give RF connection to clients.

### 4. *Coping with Augmented Reality*

As augmented reality moves toward becoming conveyed on convenient and individual gadgets, so the request on organize execution is significantly expanded. A key viewpoint is that the inactivity or defer must be little to empower genuine collaboration between the genuine and virtual situations. The human mind is extremely delicate to time postpones when handling visual information along these lines, unless the deferral is sufficiently little, genuine virtual reality services can't be conveyed. Each progression in the connection amongst gadget and server must be enhanced for extraordinary low latency and additionally the overall round trip time. New signal/routing designs will likewise be required as the general latency required can't be accomplished utilizing customary concentrated server models. So it is normal that basic low latency services will require infra-structure and engineering to find the service/server near the client, to guarantee latency amongst client and administration is limited.

### 5. *Network Densification*

It was viewed when 3G systems ended up congested, versatile administrators acknowledged they expected to add more cells and divisions to the framework to expand limit



(as opposed to expand scope). This has advanced to incorporate numerous kinds of little cells that offer greater availability choices to the client in high limit regions. With 5G, the systems are probably going to comprise of a few layers of network from a wide territory large scale layer for bring down information speed network, through different layers, to a limited layer for high information speeds. System arrangement and coordination are significant difficulties here that should be tended to as they increment exponentially with the number of system layers. This makes new difficulties for field sending and scope streamlining, for the entrance/ center system Radio Resource Management (RRM) calculation enhancement, and for gadget versatility estimation/revealing capacities.

## VI. CONCLUSION

In spite of the fact that 5G ought to speak to a noteworthy advance up from current 4G and 3G systems, the new innovation won't instantly supplant its antecedent - in any event, not in the first place. Rather, 5G should interface in with existing systems to guarantee clients never lose association, with the more established systems going about as move down in zones not secured by the new 5G scope. Yet, much as 4G has to a great extent assumed control from 3G as system scope has enlarged, 5G should bit by bit turn out to be more across the board and in the end supplant the past age, with gadgets propelling after 2020 anticipated that would accompany availability to the new systems as a matter of course. 5G is relied upon to give significantly quicker download and transfer speeds than 4G systems, taking into account speedier gushing and downloading. Alleged "4.5G" systems (otherwise called LTE-An) are set to fill the hole for the present, offering associations that are speedier than current 4G systems, albeit just certain nations, for example, South Korea can profit by them at this moment.

5G systems are primarily planned for dealing with a more prominent decent variety of information administrations, rather than basic browsing/streaming or long range informal communication information limit increments. System densification is extremely appropriate for expanding the limit and information rate to meet future requests. It is likely that the high cost ramifications of creating a totally new backhaul system will rather drive the industry to grow new advances

that can re-utilize and grow existing IP organize innovation and framework in a more productive manner. To help these necessities, there are as of now inquire about exercises exploring particular advancements for use with 5G systems, with the point of proposing arrangements that will be incorporated into 5G organize particulars.

## REFERENCES

- [1] D. Kahn, the Codebreakers, Macmillan, New York, 1967.
- [2] Pallavi Chavan, Vijay Mangrulkar, R.S, "Encrypting Informative Color Image Using Color Visual Cryptography", Emerging Trends in Engineering and Technology(ICETET), 2010.
- [3] Hyoung Joong Kim; Yongsoo Choi, "A new visual cryptography using natural images", IEEE International Symposium on Circuits and Systems (ISCAS) 2005, vol 6, pp. 5537-5540.
- [4] Abhishek Gupta, Sandeep Mahapatra and Karanveer Singh, "Data Hiding in Color Image Using Cryptography with Help of ASK Algorithm", (ETNCC), 2011.
- [5] Johnson, Neil F., and Sushil Jajodia. "Exploring Steganography: Seeing the Unseen." IEEE Computer Feb. 1998, pp. 26-34.
- [6] FIPS. 46-3, „Data Encryption Standard,” Federal Information Processing Standard (FIPS), Publication 46-3, National Bureau of Standards, US. Department of Commerce, Washington D.C. October 25, 1999.
- [7] Clair, Bryan. "Steganography: How to Send a Secret Message.", [www. strangehorizons.com /](http://www.strangehorizons.com/) 2001 / 20011008 / [steganography.shtml](http://steganography.shtml) 8Nov. 2001.
- [8] Denning, Dorothy E. Information Warfare and Security. Boston, MA: ACM Press, 1999, pp. 310-313.
- [9] T. Morkel, J. H. P. Eloff, M. S. Olivier, "An Overview of Image Steganography", Information and Computer Security Architecture (ICSA) Research Group, Department of CS, University of Pretoria, SA.
- [10] Kevin Peng, Harry Sanabria, Derek Wu, Charlotte Zhu, "Security Overview of QR Codes", Massachusetts Institute of Technology 6.857 Computer and Network Security.
- [11] B. Padmavathi, S. Ranjitha Kumari, A Survey on Performance Analysis of DES, AES and RSA Algorithm along with LSB Substitution Technique.
- [12] Majithia Sachin, Dinesh Kumar, Implementation and Analysis of AES, DES and Triple DES on GSM Network.
- [13] Dr. Purna Mahajan & Abhishek Sachdeva, A Study of Encryption Algorithms AES, DES and RSA for Security.
- [14] Diaa Salama Abdul. Elminaa1, Hatem Mohamed Abdul Kader and Mohie Mohamed Hadhoud, Performance Evaluation of Symmetric Encryption Algorithms.
- [15] Sumitra, Comparative Analysis of AES and DES security Algorithms.