# REPORT

## PRAGATI ENGINEERING COLLEGE

(ApprovedbyAICTE,PermanentlyAffiliatedtoJNTUK,KAKINADA&AccreditedbyNBA)

1-378,A.D.B.Road,Surampalem,NearPeddapuram-533437

# “Quantum Computing for Image Processing”

**Date: 28-6-2025**

**Day:** Saturday

Turing Club organised by the Dept. of CSE – AI&ML of Pragati Engineering College in association with Career Guidance Cell is organizing a seminar on "***Quantum computing for image processing"*** as part of Industry 4.0.

## Attendance list :

| S.NO | Name | Attendance Percentage |
|---|---|---|
| 1. | Abhi Ram | 100% |
| 2. | Abhilasya Mummidi | 100% |
| 3. | Ahmadunnisa Shaik | 100% |
| 4. | Ajay Dasari | 100% |
| 5. | Aluri THARUN CHOWDARY | 100% |
| 6. | Anjani Surya Prabha Katta | 100% |
| 7. | Bannu 248 | 100% |
| 8. | Bhanu Prakash | 100% |
| 9. | Bhanu Praveen Mathsa | 100% |
| 10. | bhaskar pithani | 100% |
| 11. | Bhavya P | 100% |
| 12. | Brighton bascom | 100% |
| 13. | Chaitanya sreya Amjuri | 100% |
| 14. | Chandra kranthi Tumu | 100% |
| 15. | Charan teja | 100% |
| 16. | Charishma | 100% |
| 17. | Diwakar Uday | 100% |
| 18. | Dr. A. Radha Krishna | 100% |
| 19. | Durga Prasad | 100% |
| 20. | Ethakota ADithya | 100% |
| 21. | Gh Chandana | 100% |
| 22. | Hari Deepika Bhupathi | 100% |
| 23. | harsha madhuri reddy kovvuri | 100% |
| 24. | harshitharaju M | 100% |
| 25. | Hemanth Agutumudi | 100% |
| 26. | Inakollu naveen | 100% |
| 27. | Kavya Anjali | 100% |
| 28. | Kavya Tanneeru | 100% |
| 29. | Kavya_ reddy42 | 100% |
| 30. | Kolli Navya Jyothi | 100% |
| 31. | Koumudi | 100% |
| 32. | KSR MANJUSHA | 100% |
| 33. | Kusuma Chikkala | 100% |
| 34. | Lakshmisri Manivisetti | 100% |
| 35. | Lavanya Geddada | 100% |

| | | |
|---|---|---|
| 36. | Leela Leela | 100% |
| 37. | Manasa Kondepudi | 100% |
| 38. | Mande Anushka | 100% |
| 39. | Mani Deepika Mygapula | 100% |
| 40. | Manikanta | 100% |
| 41. | Mathrusri Burri | 100% |
| 42. | Meghana Kudupudi | 100% |
| 43. | Nunna Naga sri Lakshmi | 100% |
| 44. | P.Jyothika Sri | 100% |
| 45. | Pasupuleti Vardhini | 100% |
| 46. | Pavan Kumar | 100% |
| 47. | PAVAN PEDDIREDDI | 100% |
| 48. | Pinjala Teja sri | 100% |
| 49. | pradeep Oruganti | 100% |
| 50. | Prasanna Kumari Teki | 100% |
| 51. | Praveena Kalla | 100% |
| 52. | Prudhvi Krishna | 100% |
| 53. | Pujitha Dasireddy | 100% |
| 54. | Puppala Satyavathi | 100% |
| 55. | Radha Krishna Addala | 100% |
| 56. | Rajesh Kondi | 100% |
| 57. | Rama Tulasi | 100% |
| 58. | Ramaneswari Chinthala | 100% |
| 59. | Revathi G | 100% |
| 60. | sahitya Vaddi | 100% |
| 61. | Sai Barla | 100% |
| 62. | Sai Supratheek | 100% |
| 63. | Sai swarup Katta | 100% |
| 64. | Sai Tejaswara Reddy Nagasani | 100% |
| 65. | Santhi Thota | 100% |
| 66. | Santoshi | 100% |
| 67. | Satya sai | 100% |
| 68. | Satyanarayana kothapalli | 100% |
| 69. | Sharon Allampalli | 100% |
| 70. | Sherly Thummalapalli | 100% |
| 71. | Sindhu Mendu | 100% |
| 72. | Sowmya | 100% |
| 73. | Sowmya Jyothi | 100% |

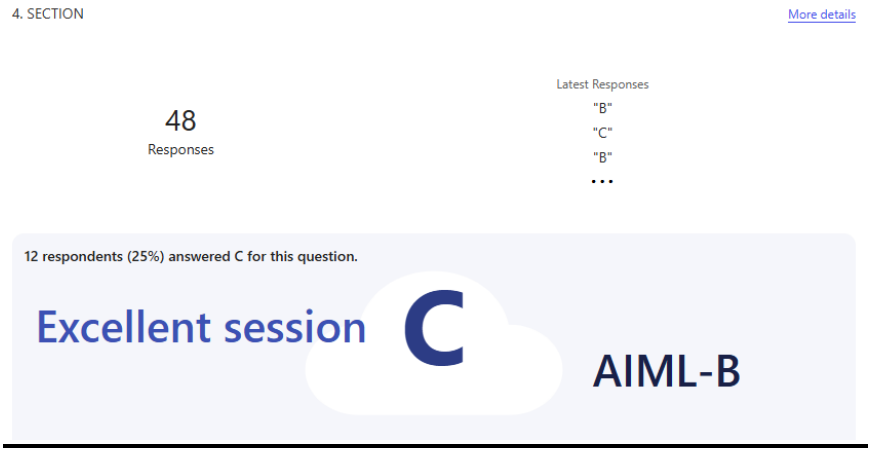
| | | |
|---|---|---|
| 74. | Sri | 100% |
| 75. | Sri Vanaja Geetha Kola | 100% |
| 76. | SRIDURGA DASAM | 100% |
| 77. | Srilaya Maddukuri | 100% |
| 78. | Sriram Putcha | 100% |
| 79. | Srisai Varsha | 100% |
| 80. | Sriya Dudala | 100% |
| 81. | Stephen babu Kadali | 100% |
| 82. | Sudhapusa | 100% |
| 83. | Sudheeksha Vydadi | 100% |
| 84. | Sudheer Pabbu | 100% |
| 85. | Suganya Kotha | 100% |
| 86. | Tanagala Tarak Sai | 100% |
| 87. | Tejaswini Dasari | 100% |
| 88. | U.S.N. Raju | 100% |
| 89. | U.S.N. Raju | 100% |
| 90. | Umasai Peruri | 100% |
| 91. | V. ANANTHA LAKSHMI | 100% |
| 92. | Vamsi Yadav | 100% |
| 93. | Variaja Vipparthi | 100% |
| 94. | Vasavi Chakka | 100% |
| 95. | Venkata Satyanarayana Achutha | 100% |
| 96. | Vennela Nunna | 100% |
| 97. | Vinod Babu | 100% |
| 98. | Yogitha Ramya sri Chodisetti | 100% |

# FEED BACK ANALYSIS

| ID | Name | ROLL NUMBER | SECTION | CONTENT | speaker communication | CONTENT DELIVERY | ANY OTHER SUGGESTION |
|---|---|---|---|---|---|---|---|
| 1 | PEDDIREDDI LAKSHMI KRISHNA PAVAN PEC | 23A31A42C3 | B | 5 | 5 | 5 | Nothing |
| 2 | BAGADI RAJESH PEC | 23A31A42A0 | B | 4 | 4 | 4 | Good experience |
| 3 | VANAPARTHI SIDDARTHA PEC | 23A31A42D0 | B | 4 | 4 | 4 | Nothing |
| 4 | SABBELLA KAVYA SUVARNIKA PEC | 23A31A4289 | B | 5 | 5 | 5 | |
| 5 | KURASA VEERA VENKATA SATYA SAI PEC | 23A31A42B5 | B | 4 | 4 | 4 | Nothing |
| 6 | K MANIKANTA SAIRAM PEC | 24A35A4210 | AIML-B | 5 | 5 | 5 | ... |
| 7 | A THARUN CHOWDARY PEC | 24A35A4203 | A | 5 | 5 | 5 | No |
| 8 | YELIDINDI RAMA TULASI PEC | 23A31A4231 | A | 5 | 4 | 4 | |
| 9 | KOPPISETTI SRIJA PEC | 23A31A4211 | A | 2 | 2 | 2 | No |
| 10 | KUNDALA PRUDHVI VEERA NARASIMHA KRISHNA PEC | 23A31A42B3 | B | 4 | 4 | 4 | |
| 11 | PENUGONDA MADHURI TEJA PEC | 23A31A4221 | A | 5 | 4 | 5 | |
| 12 | MUMMIDI M MANIKANTA DURGA SAI PRASANTH PEC | 23A31A42C1 | B | 5 | 5 | 5 | Nothing |
| 13 | ORUGANTI PRADEEP KUMAR PEC | 23A31A42C2 | B | 5 | 5 | 5 | No |
| 14 | M SANDEEP PEC | 24A35A4215 | C | 5 | 5 | 5 | No |
| 15 | P U S GANGA BHAVANI PEC | 24A35A4214 | C | 5 | 4 | 4 | All gud |
| 16 | AGUTUMUDI HEMANTH PEC | 23A31A4232 | A | 5 | 5 | 5 | |
| 17 | KUDUPUDI MEGHANA PEC | 23A31A4280 | B | 5 | 4 | 4 | No |
| 18 | KALAGA CHANDINI NAGA LEELA PEC | 23A31A4277 | Excellent session | 5 | 5 | 5 | Nothing |
| 19 | K GOWTHAM KARTHIK PEC | 24A35A4204 | A | 5 | 4 | 5 | NA |
| 20 | PAMPANA JYOTHIKA SRI RAMANI PEC | 23a31a4287 | B | 5 | 4 | 4 | Nothing |
| 21 | MANDE JAYATHI SRI ANUSHKA PEC | 23A31A4281 | B | 5 | 5 | 5 | |
| 22 | KUDUPUDI MEGHANA PEC | 23A31A4278 | B | 5 | 5 | 5 | None |
| 23 | MATHSA BHANU PRAVEEN PEC | 23A31A42B7 | B | 4 | 4 | 4 | No |
| 24 | DASARI AJAY KUMAR PEC | 23A31A42A2 | A | 5 | 5 | 5 | |
| 25 | KUDUPUDI MEGHANA PEC | 23A31A4267 | B | 4 | 4 | 4 | Nio |
| 26 | CHIKKALA KUSUMA | 24A31A4271 | B | 5 | 5 | 5 | None |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | CHANDU PEC | | | | | | |
| 27 | TANNEERU KAVYA VENKATA SRI PEC | 23A31A4294 | B | 5 | 5 | 5 | Na |
| 28 | D S KANAKA DURGA PEC | 24A35A4207 | B | 4 | 4 | 4 | |
| 29 | GUTTULA AMRUTHA NOOKAMBIKA PEC | 23A31A4205 | A | 5 | 5 | 5 | |
| 30 | MONDI KOUSALYA PEC | 23A31A42E8 | C | 4 | 4 | 4 | |
| 31 | PYDIKONDALA LEELA MAHALAKSHMI PEC | 23A31A42F2 | C | 5 | 5 | 5 | NA |
| 32 | DASARI TEJASWINI PEC | 23A31A42D8 | C | 4 | 3 | 2 | No |
| 33 | BURRI MATHRUSRI PEC | 23A31A42D5 | C | 5 | 5 | 5 | No |
| 34 | THOTA SANTHI PEC | 23A31A4296 | B | 5 | 5 | 5 | |
| 35 | CHODISETTI YOGITHA RAMYA SRI PEC | 23A31A42D7 | C | 5 | 5 | 5 | No |
| 36 | CHAKRAVARTHULA SRI SAI VARSHA PEC | 23A31A42D6 | C | 5 | 5 | 5 | Nothing |
| 37 | BURRI MATHRUSRI PEC | 23A31A42F8 | C | 5 | 5 | 5 | No |
| 38 | K SATYANARAYANA PEC | 24A35A4211 | B | 5 | 5 | 5 | None |
| 39 | DUDALA SRIYA PEC | 23A31A42D9 | C | 5 | 5 | 5 | |
| 40 | TUMU CHANDRA KRANTHI PEC | 23A31A42F7 | C | 5 | 4 | 5 | No |
| 41 | KOTHA SUGANYA PEC | 23A31A4279 | B | 5 | 5 | 5 | None |
| 42 | NUNNA NAGA SRILAKSHMI PEC | 23A31A4285 | B | 5 | 5 | 5 | |
| 43 | CHINTALA RAMANESWARI PEC | 23A31A4272 | B | 5 | 4 | 4 | NA |
| 44 | KOTHA HARISHANKAR PEC | 23A31A42B2 | B | 3 | 4 | 4 | Nothing |
| 45 | MOHAMMED ASMA PEC | 23a31a4284 | B | 5 | 5 | 5 | |
| 46 | CHAKKA VASAVI PEC | 23A31A4270 | B | 4 | 5 | 4 | No |
| 47 | KATTA ANJANI SURYA PRABHA PEC | 23A31A42E2 | C | 4 | 4 | 3 | No |
| 48 | MANEPALLI GAYATHRI BHAVANA DEVI PEC | 23A31A4282 | B | 4 | 4 | 4 | NOTHING |

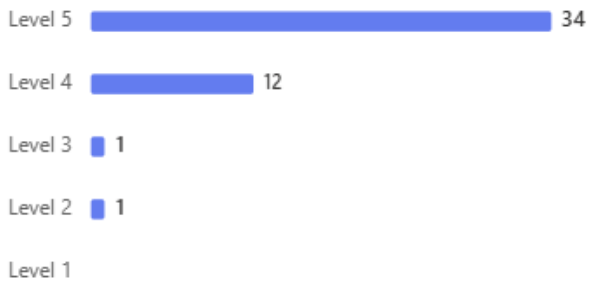
**How satisfied were you with the session content:**



5. CONTENT

4.65

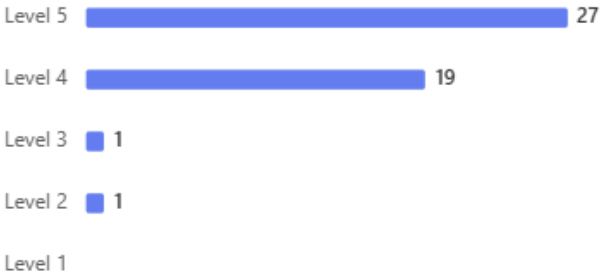
Average Rating




6. speaker communication

4.50

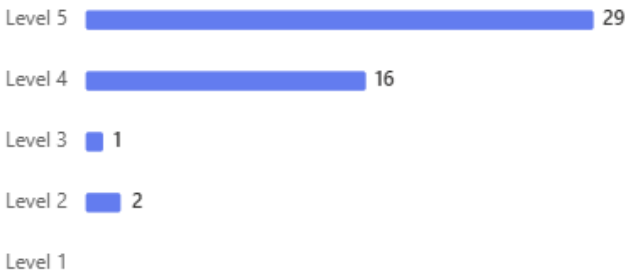
Average Rating




7. CONTENT DELIVERY

4.50

Average Rating




Overall rating: **Very Good**

## Content Delivered in the Event:

# Quantum Computing for Image Processing

### 1. Introduction to Digital Image Processing

Digital image processing is a field that enhances, analyzes, and interprets images using computational techniques. It is a cornerstone of modern computer vision systems. Human vision is the most advanced sensory mechanism, and digital image processing aims to mimic and extend this capability through computers.

The process includes converting an image into a digital form and performing operations using algorithms. Digital images are classified into:

- Binary images (black and white),
- Grayscale images (monochrome intensity),
- Color images (RGB representation).

Applications of image processing span across fields like medical imaging, remote sensing, autonomous vehicles, industrial inspection, entertainment, and scientific research.

### 2. Overview of Quantum Computing

Quantum computing is a transformative computational paradigm based on the principles of quantum mechanics. Unlike classical computers that use bits (0 or 1), quantum computers use qubits, which can exist in a superposition of states (both 0 and 1 simultaneously).

Key quantum phenomena include:

- Superposition: Enables parallel processing by allowing qubits to exist in multiple states.
- Entanglement: Links qubits in such a way that the state of one affects the state of another, regardless of distance.
- Interference: Helps in amplifying the correct solutions and cancelling incorrect ones.

Quantum computing is poised to outperform classical systems for specific problems like cryptography, optimization, and molecular modeling.

### 3. Evolution of Quantum Computing

The development of quantum computing is categorized into five major phases:

1. Theoretical Foundations (1900–1980) – Established by pioneers like Max Planck and Einstein.
2. Emergence (1980–1994) – Initiated by Richard Feynman's and Yuri Manin's proposals on quantum simulations.

3. Quantum Algorithms (1994–2000) – Marked by the development of groundbreaking algorithms like Shor's (for factoring) and Grover's (for searching).
4. Race to Build (2000–2021) – A competitive phase involving global tech giants aiming to build functional quantum hardware.
5. Ongoing Advancements (2021–present) – With continued innovation, research, and the rise of quantum supremacy.

## 4. Bits vs. Qubits

While classical computation revolves around bits (binary digits), quantum computing revolves around qubits. A qubit, represented mathematically as a combination of $|0\rangle$ and $|1\rangle$ using complex probability amplitudes, is a unit vector in a 2D complex vector space.

The Bloch Sphere provides a geometrical representation of qubit states, emphasizing the probabilistic nature of measurement. Unlike bits, measuring a qubit collapses it to one of its basis states with probabilities $|\alpha|^2$ and $|\beta|^2$ respectively.

## 5. Quantum Logic Gates

Quantum gates are the operational units of quantum circuits, similar to logic gates in classical computing. They manipulate qubits through unitary transformations and can exist as:

- Single Qubit Gates: Identity (I), Pauli-X, Y, Z; Hadamard (H); Phase gates (S, T); Rotation gates (RX, RY, RZ).
- Two Qubit Gates: CNOT, CY, CZ, SWAP, iSWAP, √SWAP.
- Three Qubit Gates: Toffoli (CCX), Fredkin (CSWAP), Multi-Controlled gates.
- Special Gates: Clifford + T, Non-Clifford gates, Surface Code Gates, Transversal gates.

These gates are key in performing quantum operations essential to image transformation.

## 6. Image Processing Using Quantum Gates

Quantum Image Processing (QIP) leverages the power of quantum computation to enhance traditional image processing methods. By encoding image data into quantum states, quantum gates are used to process them, offering:

- Faster processing through parallelism,
- Better encryption due to inherent quantum security,
- Efficient compression and denoising,
- Reduced memory requirement for storing large images.

A classical image is encoded into a quantum state, manipulated using quantum gates, and decoded back into a classical format post-processing.

## 7. Quantum Image Representations

Several quantum image models have been developed to store and process digital images:

1. FRQI (Flexible Representation of Quantum Images) – Encodes grayscale images using position and intensity in qubits.
2. NEQR (Novel Enhanced Quantum Representation) – Provides an efficient model for image retrieval and classification.
3. NCQI (Novel Quantum Representation of Colored Images) – Aims at representing color data effectively.
4. OCQR (Optimized Color Quantum Representation) – Enhances efficiency in color image encoding.
5. FRQCI (Flexible Representation of Quantum Color Image) – Focuses on color representation flexibility.

These models differ based on how pixel intensity and position are encoded. Quantum image encoding supports compact representation and parallel processing.

## 8. Classical vs. Quantum Processing

In classical systems:

- Bits are manipulated using logic circuits.
- Processing power increases linearly with transistors.
- Systems are error-resilient and operate at room temperature.

In quantum systems:

- Qubits allow simultaneous processing.
- Computational power increases exponentially with the number of qubits.
- Systems are error-prone and need ultracold environments.
- Best suited for tasks requiring parallelism, such as optimization, AI, and image processing.

A side-by-side comparison demonstrates how quantum computers offer a significant edge in handling complex image tasks more efficiently.

## 9. Applications of Quantum Image Processing

Quantum image processing is a rapidly evolving field with potential applications in:

- Medical Imaging – Faster analysis and diagnosis.
- Remote Sensing – Quantum-enhanced satellite imaging.
- Autonomous Vehicles – Real-time object recognition.
- Industrial Inspection – Detecting anomalies in production lines.
- Artificial Intelligence – Improved computer vision systems.
- Document Processing – Efficient scanning and recognition.
- Entertainment & Media – Enhanced rendering and compression.

## 10. Future Prospects

Quantum computing is still in its nascent stage. However, as hardware matures and error-correction improves, its role in image processing will grow. Hybrid models integrating classical and quantum systems will be pivotal during the transition phase.

Researchers must focus on:

- Developing robust quantum algorithms,
- Designing practical quantum circuits for image processing tasks,
- Ensuring reliable quantum-classical interfacing,
- Exploring real-world applications beyond academic settings.

## Conclusion

This presentation thoroughly explores the intersection of quantum computing and image processing. While classical methods have served well, quantum computing opens new horizons for speed, efficiency, and capability. Through concepts like superposition, entanglement, and quantum gates, image processing tasks can be executed with unprecedented efficiency. Quantum image representation models like FRQI and NEQR demonstrate real potential in storing and manipulating digital images. As research and technology progress, quantum-enhanced image processing is set to revolutionize fields like medical imaging, AI, and remote sensing.

# Photos:


Yamuna Lakkamsani
U.S.N. Raju
Radha Krishna Addala
96 others
Dr. Gollapalli Naresh
1:33 PM | hug-oesq-znz


U.S.N. Raju (Presenting)
Quantum Computing for Image Processing
Dr.U.S.N.Raju
Associate Professor,
Dept. of CSE, NIT Warangal
Yamuna Lakkamsani
Radha Krishna Addala
98 others
People
Add people
Search for people
IN THE MEETING
Contributors 101
Yamuna Lakkams... (You)
Meeting host
Abhi Ram
Abhilasya Mummidi
Ahmadunnisa Shaik
Ajay Dasari
Akshaya Gunisetti
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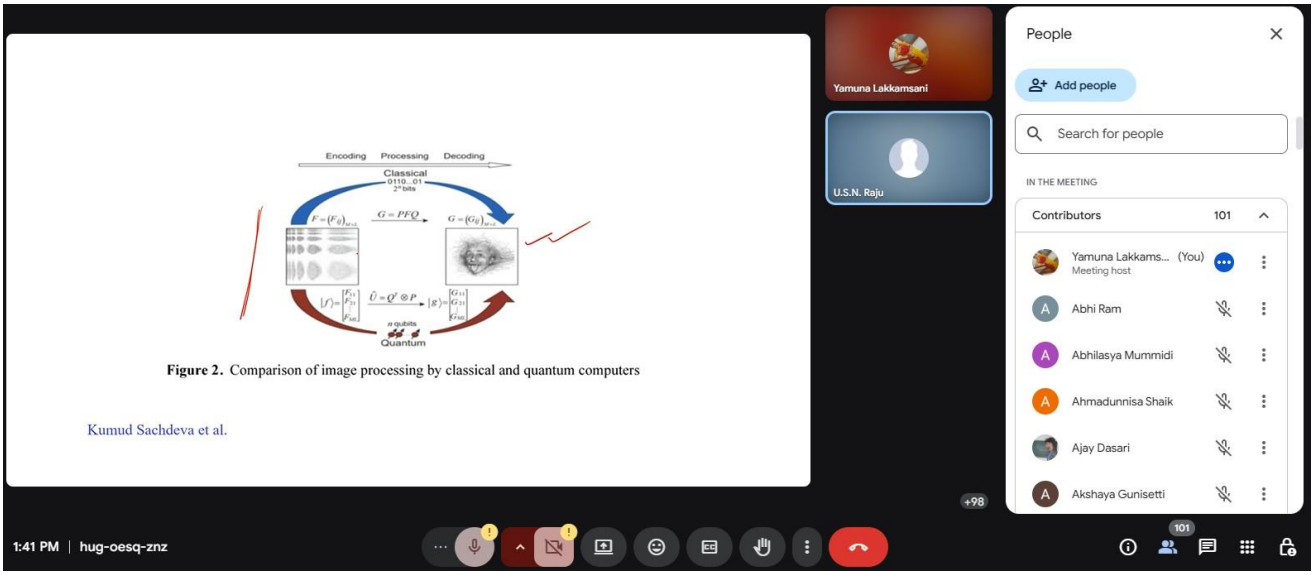
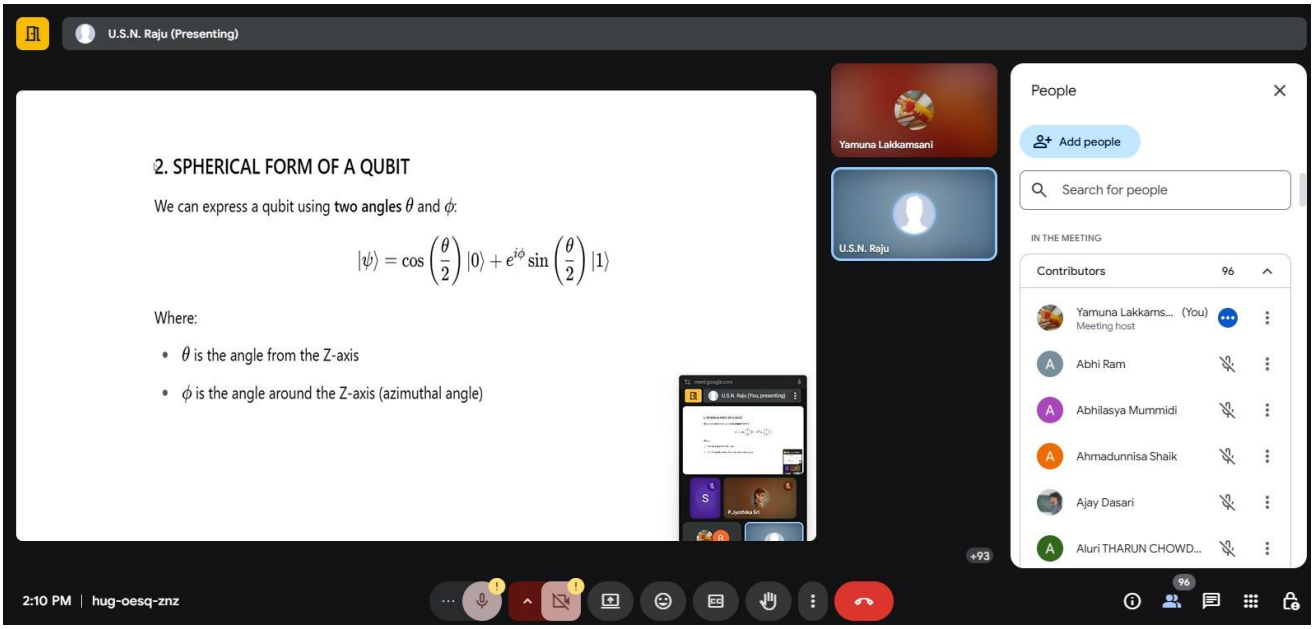
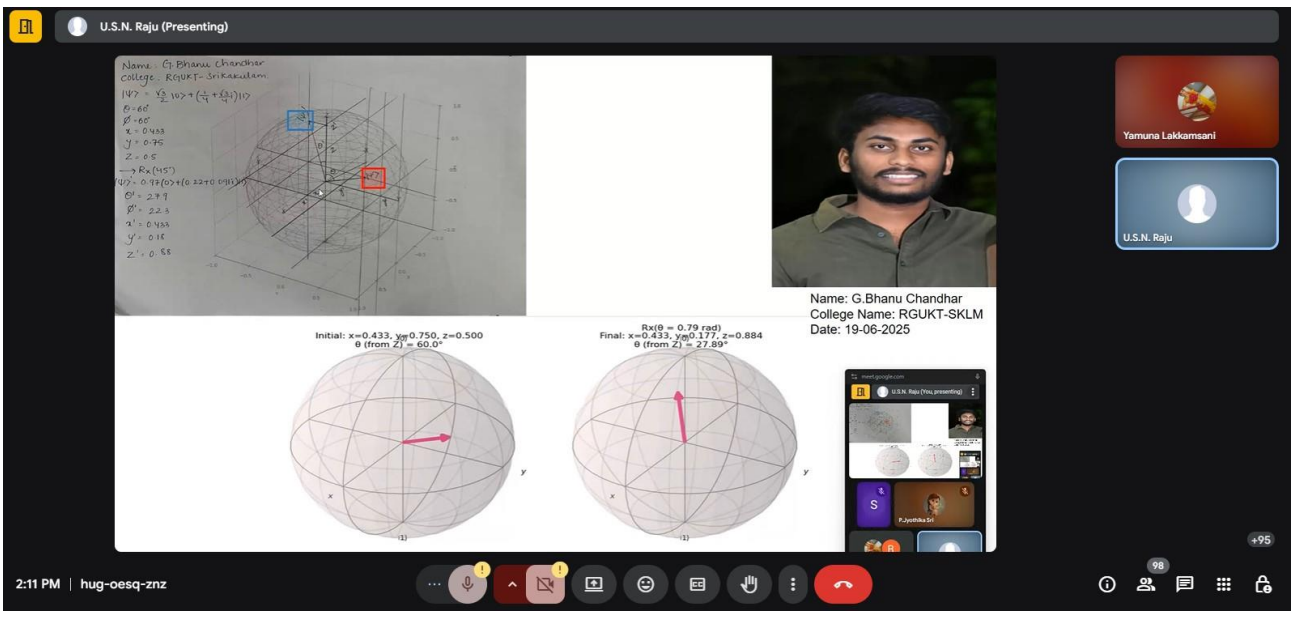
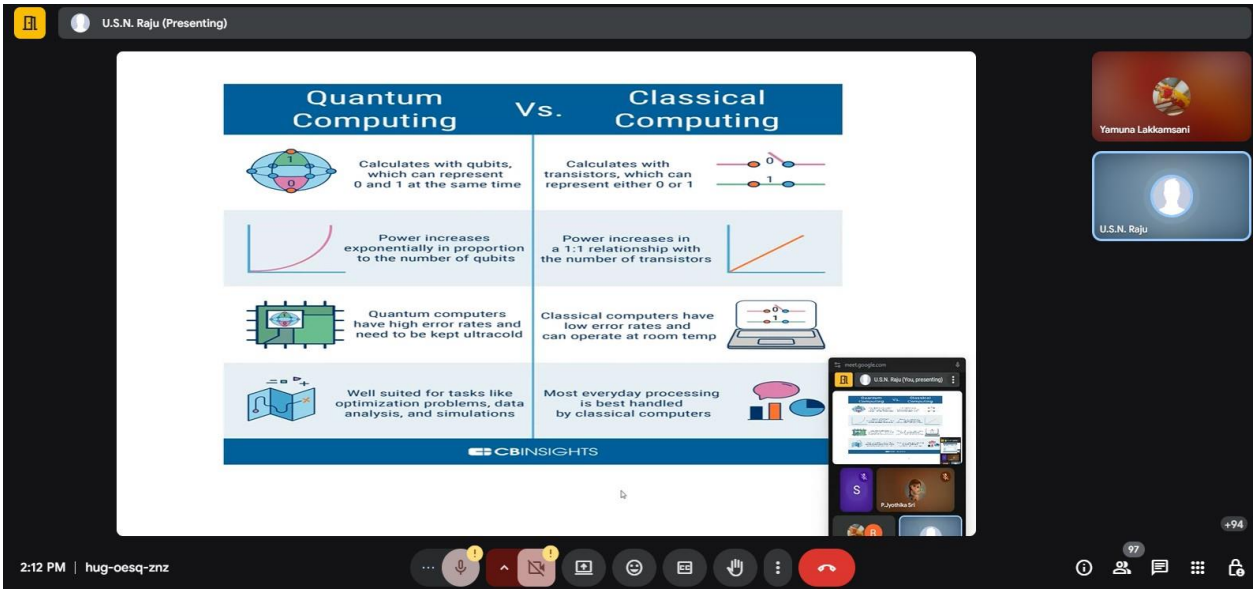


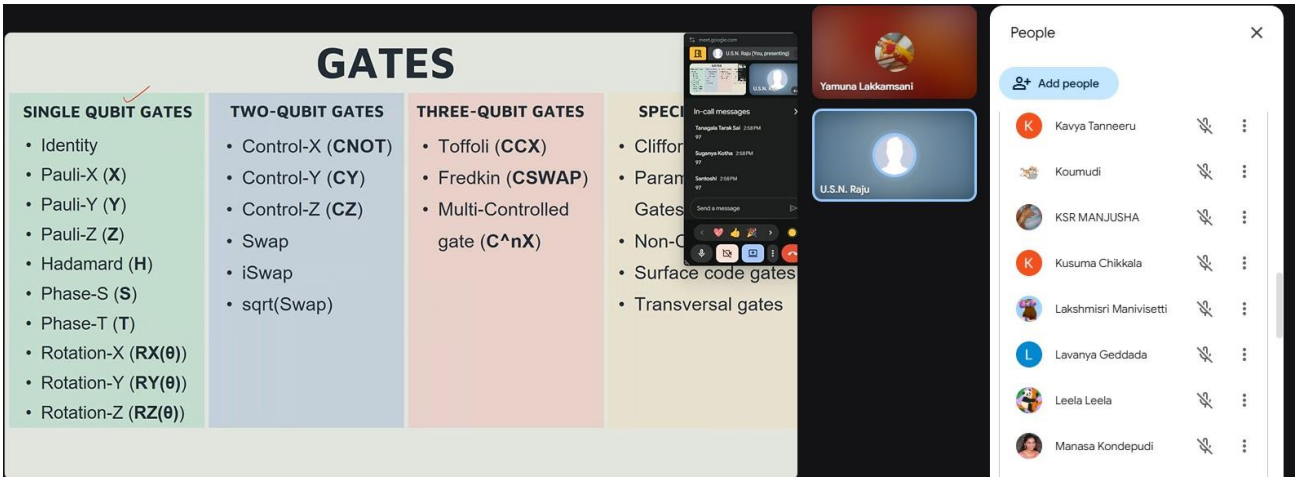

**Figure 2.** Comparison of image processing by classical and quantum computers

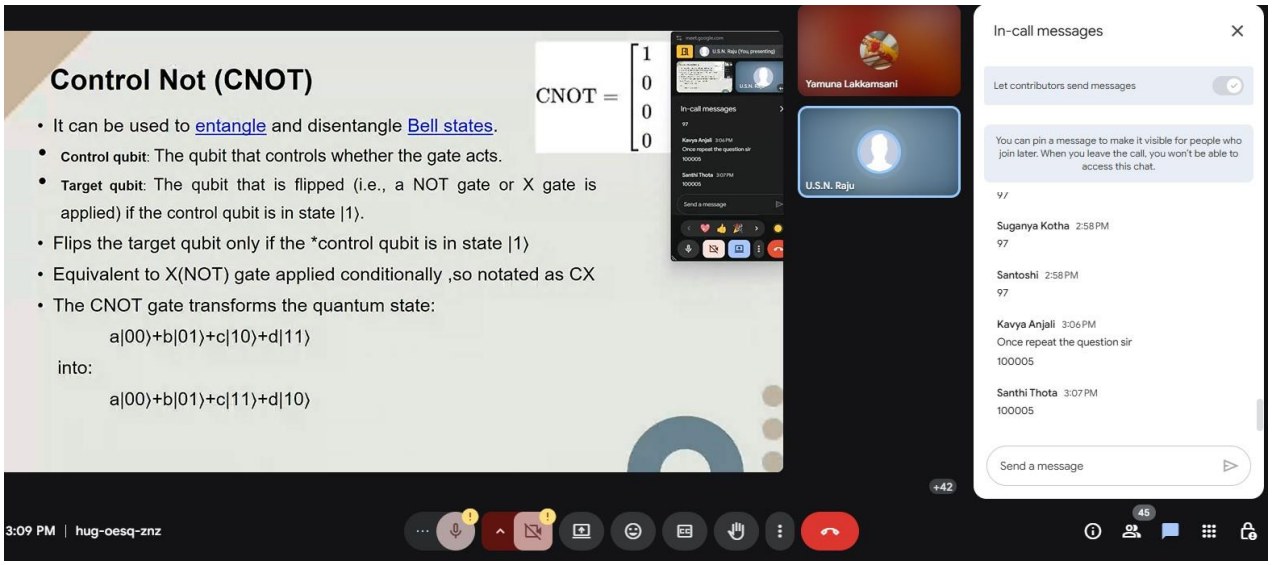
Kumud Sachdeva et al.

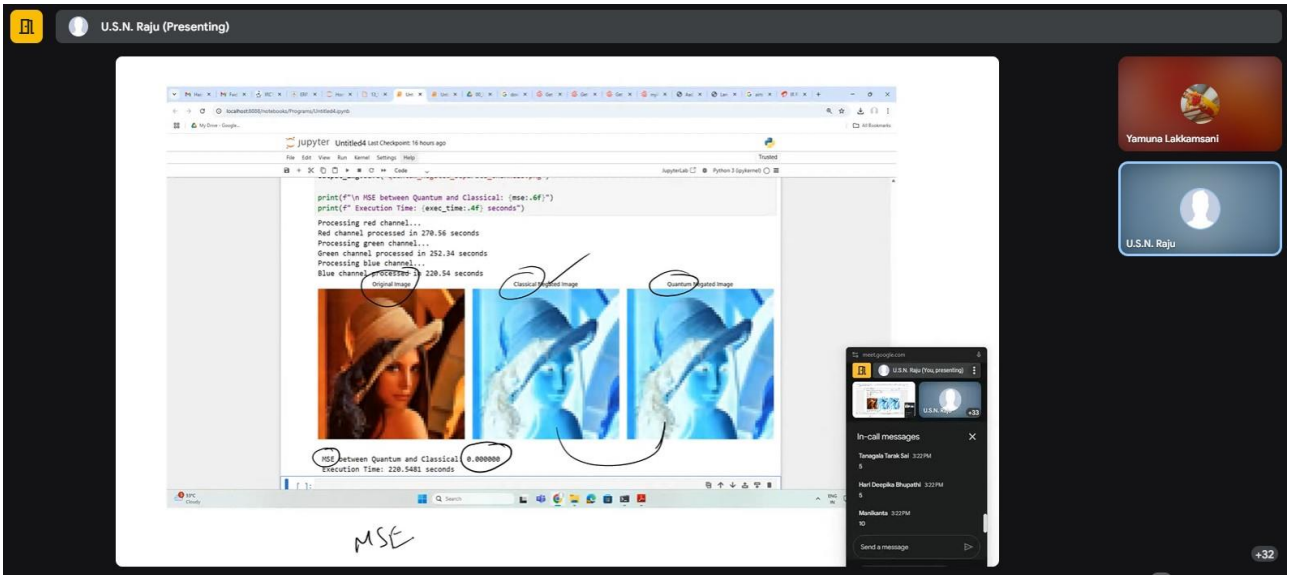


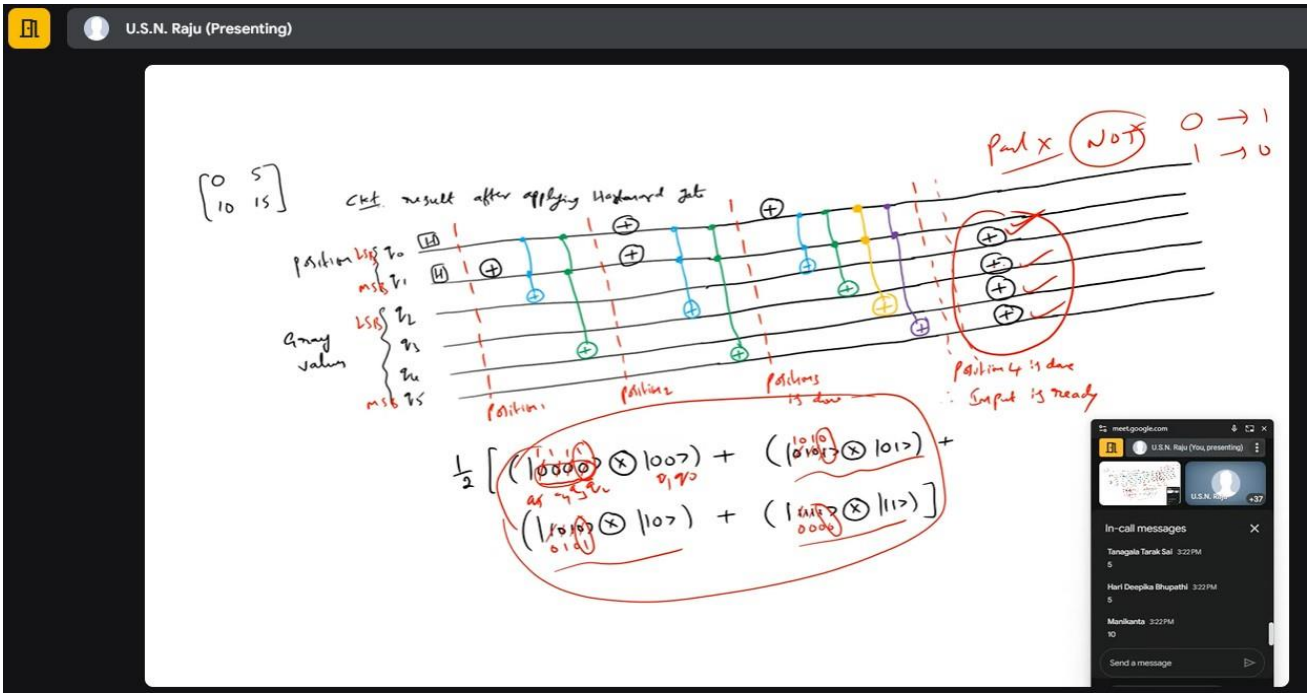




U.S.N. Raju (Presenting)
Quantum Computing
Vs.
Classical Computing
Calculates with qubits, which can represent 0 and 1 at the same time
Calculates with transistors, which can represent either 0 or 1
Power increases exponentially in proportion to the number of qubits
Power increases in a 1:1 relationship with the number of transistors
Quantum computers have high error rates and need to be kept ultracold
Classical computers have low error rates and can operate at room temp
Well suited for tasks like optimization problems, data analysis, and simulations
Most everyday processing is best handled by classical computers
CBINSIGHTS
Yamuna Lakkamsani
U.S.N. Raju
2:12 PM | hug-oesq-znz


GATES
SINGLE QUBIT GATES
Identity
Pauli-X (X)
Pauli-Y (Y)
Pauli-Z (Z)
Hadamard (H)
Phase-S (S)
Phase-T (T)
Rotation-X (RX(θ))
Rotation-Y (RY(θ))
Rotation-Z (RZ(θ))
TWO-QUBIT GATES
Control-X (CNOT)
Control-Y (CY)
Control-Z (CZ)
Swap
iSwap
sqrt(Swap)
THREE-QUBIT GATES
Toffoli (CCX)
Fredkin (CSWAP)
Multi-Controlled gate (C^nX)
Surface code gates
Transversal gates
Yamuna Lakkamsani
U.S.N. Raju
People
Add people
Kavya Tanneeru
Koumudi
KSR MANJUSHA
Kusuma Chikkala
Lakshmisri Manivisetti
Lavanya Geddada
Leela Leela
Manasa Kondepudi


Control Not (CNOT)
CNOT = 1 0 0 0
It can be used to entangle and disentangle Bell states.
Control qubit: The qubit that controls whether the gate acts.
Target qubit: The qubit that is flipped (i.e., a NOT gate or X gate is applied) if the control qubit is in state |1⟩.
Flips the target qubit only if the *control qubit is in state |1⟩
Equivalent to X(NOT) gate applied conditionally ,so notated as CX
The CNOT gate transforms the quantum state:
a|00⟩+b|01⟩+c|10⟩+d|11⟩
into:
a|00⟩+b|01⟩+c|11⟩+d|10⟩
Yamuna Lakkamsani
U.S.N. Raju
In-call messages
Let contributors send messages
You can pin a message to make it visible for people who join later. When you leave the call, you won't be able to access this chat.
Suganya Kotha 2:58 PM
97
Santoshi 2:58 PM
97
Kavya Anjali 3:06 PM
Once repeat the question sir
100005
Santhi Thota 3:07 PM
100005
Send a message
3:09 PM | hug-oesq-znz


U.S.N. Raju (Presenting)
Yamuna Lakkamsani
U.S.N. Raju
jupyter Untitled4 Last Checkpoint: 16 hours ago
print(f"\n MSE between Quantum and Classical: {mse:.6f}")
print(f" Execution Time: {exec_time:.4f} seconds")
Processing red channel...
Red channel processed in 270.56 seconds
Processing green channel...
Green channel processed in 252.34 seconds
Processing blue channel...
Blue channel processed in 220.54 seconds
Original Image
Classical Rotated Image
Quantum Rotated Image
MSE between Quantum and Classical 0.000000
Execution Time: 220.5481 seconds
In-call messages
Tanagala Tarak Sai 3:22 PM
5
Hari Deepika Bhupathi 3:22 PM
5
Manikanta 3:22 PM
10
Send a message
+32
MSE


U.S.N. Raju (Presenting)
Ckt result after applying Hadamard Jate
Position
Gray value
Position 4 is done
Input is ready
In-call messages
Tanagala Tarak Sai 3:22 PM
5
Hari Deepika Bhupathi 3:22 PM
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Manikanta 3:22 PM
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## Department of CSE (Artificial Intelligence & Machine Learning)

Organizes

A Guest Lecture (online)

# Topic: Quantum Computing for Image Processing

## Dr. U.S.N. Raju

Associate Professor in CSE Department,
NIT Warangal.

28th June-2025

In Association with IAENG (International Association of Engineers) & Turing Club

Pragati Engineering College
(AUTONOMOUS)

# PRAGATI ENGINEERING COLLEGE

Learning is Supreme Deity

**(AUTONOMOUS)**

**DEPARTMENT OF CSE (Artificial Intelligence & Machine Learning)**

**PEC / Admin / Circular / 2025 / Turing CLUB**

**Date: 24-06-2025.**

All the staff, Pragati Turing club coordinators, Third year Students are informed that a seminar on **"Quantum computing for image processing"** is being organized by Turing club & IAENG in association with career Guidance cell. The details are given below.

**Date:** 28- 6-2025
**Time:** 1:30 PM to 3:30 PM
**Venue:** Online
**Faculty Co-Ordinator:** Mrs.L.Yamuna

**Student Co-Ordinator:** B.Harika Deepika (III -year CSE (AI&ML)-23A31A42D4)
K.Navya Jyothi (III-year CSE (AI&ML)-23A31A42E3)

**Speaker:** DR U.S.N RAJU
Associate Professor,
NIT Warangal.

**Faculty coordinator** **HoD-CSE(AI&ML)**

Copy to:

1) Chairman /All Directors / Vice President for kind information.
2) Vice Principal/Dean T&P for information.
3) All HoDs are requested to circulate among your staff members.
4) Convener-Career Guidance cell
5) Office File.