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VIKRAM 3201 AND KALPANA 3201

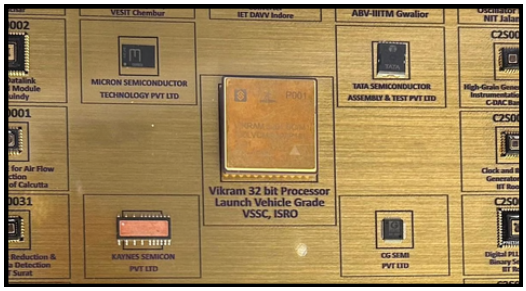
Advancing Indigenous Microprocessor Technology for Indian Space Missions

The Indian Space Research Organisation (ISRO), in collaboration with the Semiconductor Laboratory (SCL), Chandigarh, has developed two indigenous 32-bit microprocessors — Vikram 3201 and Kalpana 3201 — marking a significant milestone in India's pursuit of self-reliance in space technology. These processors, designed to meet the stringent requirements of space applications, exhibit distinct architectures and software ecosystems tailored to different mission profiles. This article provides a detailed overview and comparison of these microprocessors, assessing their design features, software support, and operational suitability.

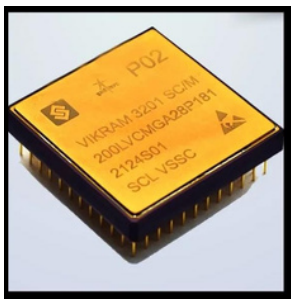
India's evolving space program demands reliable and high-performance embedded systems capable of operating in the harsh conditions of space. To address this, ISRO has successfully developed two 32-bit microprocessors: Vikram 3201, a fully indigenous processor based on a custom instruction set, and Kalpana 3201, built on the SPARC V8 Reduced Instruction Set Computer (RISC) architecture. Both processors are fabricated using 180nm CMOS technology at SCL and are tailored specifically for spaceborne applications.

Vikram 3201:

Custom ISA with Robust Floating-Point Capabilities. The Vikram 3201 processor represents India's first fully indigenous 32-bit microprocessor, designed with a custom Instruction Set Architecture (ISA) that integrates floating-point arithmetic units. Its development emphasizes reliability and precision, especially for launch vehicle and payload systems that require stringent computational accuracy.



The processor supports Ada programming language, favored in aerospace domains for its strong typing and support for real-time, safety-critical applications. The software ecosystem includes an ADA compiler, assembler, linker, simulator, and integrated development environment (IDE), enabling comprehensive development and testing. The processor has undergone rigorous space qualification and was successfully validated in flight during the PSLV-C60 mission, establishing its operational credibility.



VIKRAM 3201

Kalpana 3201:

SPARC V8 RISC for Flexibility and Open-Source Compatibility. Kalpana 3201 adopts the SPARC V8 architecture (IEEE 1754 ISA), a well-established RISC design that emphasizes simplicity and efficiency in instruction execution. Its architecture enables predictable performance and ease of verification, which are essential in space systems. Designed to be compatible with open-source toolchains, Kalpana supports a broader software development environment, including simulators and IDEs created by ISRO. While primarily validated with flight software, ongoing efforts aim to extend support to the C programming language through in-house compiler development. This makes Kalpana a versatile option for missions where open-source ecosystem and software flexibility are prioritized.

VIKRAM 3201 and KALPANA 3201

VIKRAM 3201 AND KALPANA 3201

Comparison:

Vikram 3201 and Kalpana 3201 are two 32-bit space-grade microprocessors developed by ISRO and the Semiconductor Laboratory (SCL) for use in satellites and launch vehicles. Vikram 3201 is a fully custom-designed processor with a unique instruction set and in-house software tools, making it highly tailored for critical ISRO missions like navigation and control. In contrast, Kalpana 3201 is based on the open-standard SPARC V8 architecture, which allows compatibility with widely used open-source tools, making it more flexible for general applications. While Vikram offers tighter integration and more control, Kalpana provides easier software development and faster adoption. Both processors aim to reduce dependence on foreign technology and strengthen India's self-reliance in space electronics.

Advantages of Vikram 3201:

- Fully Indigenous Design – Custom-built by ISRO for space missions, ensuring full control.
- Optimized for Critical Systems – Ideal for tasks like navigation, guidance, and control.
- Supports Floating Point Operations – Useful for high-precision calculations.
- Radiation-Tolerant – Designed to work in harsh space environments.
- Custom Instruction Set – Allows ISRO to fine-tune performance for specific mission needs.
- Proven in Space – Already used successfully in the PSLV-C60 mission.

Advantages of Kalpana 3201:

- Based on SPARC V8 Architecture – Uses a standard, well-known ISA (Instruction Set Architecture).
- Supports Open-Source Tools – Easy to develop software using standard compilers and debuggers.
- Flexible and Developer-Friendly – Faster development and easier software integration.
- Tested for Flight Software – Suitable for space missions, with compatibility in mind.
- Indigenously Made – Designed and fabricated in India, promoting self-reliance.
- Easier Software Porting – Compatible with existing aerospace and research software.

The invention of Vikram 3201 and Kalpana 3201 is a big step forward for India's space technology. These are powerful computer chips made completely in India by ISRO and SCL, and they can be used in rockets and satellites. Before this, India had to rely on foreign chips, which could be expensive or hard to get. Now, with these Indian-made processors, ISRO has more control, more safety, and can save costs. Vikram 3201 is special because it's fully custom-built for critical space tasks like navigation and flight control. Kalpana 3201 is built using a standard design, so it's easier to develop software for it and use it in different missions. Both are made to work in the harsh conditions of space. Overall, these inventions show India's strength in space technology and help the country become more self-reliant and advanced in science and engineering.

Conclusion:

The development of Vikram 3201 and Kalpana 3201 underscores a pivotal advancement in India's microprocessor design for space applications. By integrating tailored architectural features and comprehensive software support, these processors empower ISRO's missions with reliable, efficient, and domestically-produced computing platforms. Their continued evolution is vital for sustaining India's competitive edge in the global space domain

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QUANTUM COMPUTING

A New Frontier for the Next GeneratioN

In the last century, classical computers transformed the way humans live, work, and connect. From room-sized machines to smartphones in our pockets, this journey was driven by bits — tiny switches representing 0s and 1s. But as technology approaches its physical limits, a new idea has emerged to carry us forward: Quantum Computing.

Quantum computing is not just an upgrade to existing machines; it represents a fresh way of thinking about information. Instead of relying only on bits, these systems use qubits, which follow the fascinating rules of quantum mechanics. With them, computers can process information in ways that classical machines cannot, opening doors to solving problems once thought impossible.

The Quantum Leap

A classical bit can be either a 0 or a 1. A qubit, however, can be both 0 and 1 at the same time — a property called superposition. When combined with entanglement, where qubits are strongly linked together, quantum computers gain extraordinary problem-solving power.

This means they can analyze complex systems far faster than even today's supercomputers. Imagine discovering new medicines by simulating molecules, creating unbreakable codes for cybersecurity, or optimizing transportation networks for entire cities — tasks that would take classical computers centuries.

Of course, quantum computing is not easy. Qubits are delicate and easily disturbed by noise and temperature. Researchers worldwide are experimenting with different designs, such as superconducting circuits, trapped ions, and photons, to make them stable and practical.

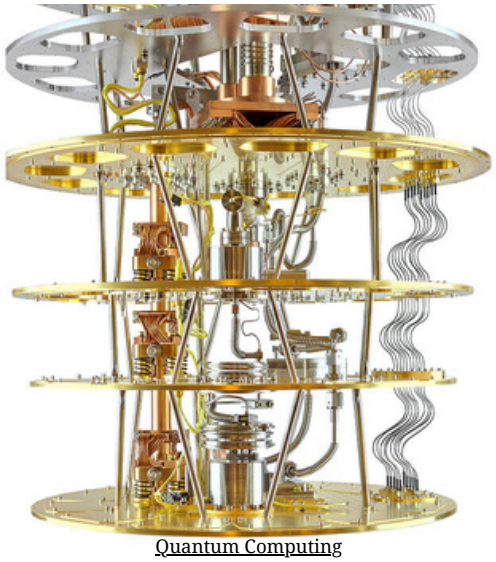
Milestones in Quantum Computing

1980s: Physicists propose the idea of computers based on quantum principles.

1990s: Algorithms reveal the power of quantum systems, especially for cryptography.

2000s: Experimental prototypes show proof-of-concept results.

2019: Google demonstrates "quantum supremacy" on a specialized problem.



Quantum Computing

Present: Companies like IBM, Microsoft, and IonQ make quantum processors accessible for research.

Future: Experts expect breakthroughs in artificial intelligence, climate modeling, and secure communication.

Why It Matters to Students

Quantum computing is still at an early stage, much like classical computing in the 1950s. But it is advancing rapidly, and the next generation of engineers, scientists, and innovators will shape how it is used.

For students, this is an invitation:

Learn across disciplines — quantum computing combines physics, mathematics, and engineering.

Be curious and bold — today's challenges in error correction, stability, and scaling are opportunities for tomorrow's breakthroughs.

Think big — the world needs new ideas, and young minds are best placed to explore them.

Conclusion:

Quantum computing is more than a technology; it is a reminder that daring ideas can change the future. Just as the transistor once reshaped society, qubits may soon redefine what machines can achieve.

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EVENTS AND WORKSHOPS

- I B.Tech EEE students have attended the Induction Programme organized for all B.Tech First Year students for the Academic Year 2025–2026, held from 04th August 2025 to 16th August 2025 at the 1979–83 Alumni Auditorium.
- **INDEPENDENCE DAY**
  79th Independence Day Celebrations on 15th August, 2025 have been held at JNTUK attended by all staff members. Flag Hoisted at JNTUK Lawns by the Hon'ble Vice-Chancellor
- II B.Tech Students have attended awareness program on PSKR – PRISM scheme is arranged on 18-08-2025 (Monday) from 3:30 pm to 4:30 pm. Lecture delivered by Prof. P. JOSHINA, Co-coordinator, TOCIC-PRISM from Sri Padmavathi MahilaVisvavidyalayam, Tirupathi at 1979-83 Alumni Auditorium, JNTUK, Kakinada
- Students of I and II B.Tech had an interactive session with Dr. Venkat Reddy Kota on "Skill Development and Career Planning." The session is focused on building essential technical and soft skills, understanding industry expectations, and planning a successful career path. Students will gain valuable insights and practical tips to enhance their employability and future prospects. Active participation is encouraged to make the most of this opportunity on 22-08-2025, 2:00 PM to 3:30 PM.

- III B.Tech and IV B.Tech students have attended the program organized by **AIC** ALEAP WEHUB under MeitY Tide 2.0 on "Innovation in Industry 4.0 & 5.0 Technologies, Incubation and Acceleration Support for Students and Faculty." organized by Design Innovation Centre, JNTUK on 26th August, 2025 from 11:00 AM to 02:00 PM.
- Students actively participated in an engaging session on Avishkarandra on 20th August 2025 which provided valuable insights into emerging innovations and the future of technology. In the event Hon'ble Cheif Minister has inaugarated this program with RATAN TATA INNOVATION HUB **(**RITH**)** at 5 cities in Andhra Pradesh to boost innovations in the state. II,III and IV B.Tech students have participated in the event.
- B.Tech students from all years actively participated in the "Swarna Andhra–Swachh Andhra: Monsoon Hygiene Activity" on 23rd August 2025. They enthusiastically cleaned the department premises and surroundings to promote hygiene, teamwork, and social responsibility during the monsoon season.

- V. KAVYA SRI from III B.Tech has won Paper Presentation in ENCURSO 2K25 held in march 15 & 16 on Topic of Oxygen Suffocating system in cars and ways to tackle using present day Technology.
- S.Tarun from II B.Tech has won Online Photography contest in ENCURSO 2K25 held in march 15 & 16.

EVENTS AND WORKSHOPS

- Dr. Venkata Reddy Kota, Professor and Head of EEE, UCEK (JNTUK), attended the Nurturing Future Leadership Program at IIM Visakhapatnam from 11th to 15th August 2025, organized under the Malaviya Mission Teacher Training Program by the Ministry of Education, Government of India. The program aimed to equip academic leaders with essential skills in institutional governance, strategic decision-making, and leadership in higher education. Dr. Venkata Reddy Kota's active participation reflects his dedication to continuous professional development and contributes significantly to the academic and administrative advancement of the institution.
- Dr. Shanmukha Naga Raju Vonteddu, University College of Engineering Kakinada (JNTUK), successfully completed a Faculty Development Programme on "Foundations of Artificial Intelligence: Concepts, Techniques, and Applications" conducted by IIT Roorkee in association with GIET University, Odisha, from 9th to 13th July 2025. The program provided in-depth coverage of fundamental AI concepts, practical tools, and emerging trends in the field, aiming to enhance participants' teaching methodologies and research capabilities. Through interactive sessions and hands-on training, attendees gained valuable insights into applying AI technologies across various domains. Dr. Vonteddu's active participation reflects his dedication and the department's ongoing commitment to staying at the forefront of advanced technological developments.
- Dr. Shanmukha Naga Raju Vonteddu assistant pofessor(c) , EEE dept. University College of Engineering (A),JNTUK had participated in E & ICT Academy, IIT Kanpur conducted a Faculty Development Program on IoT with Drone from August 5 to 16, 2025. which covered key concepts and hands-on training in IoT and drone technologies. The program aimed to enhance research and teaching skills in these emerging areas. The certificate was awarded by Prof. B. V. Phani, Chief Investigator of E & ICT Academy, recognizing the participant's successful completion and dedication.
- Mr. V.S.N.K. Chaitanya, Assistant Professor (Contract), EEE dept., University College took part in AICTE Training and Learning (ATAL) Academy Faculty Development Program. program held at R.V.S. College of Engineering and Technology from August 25, 2025, to August 30, 2025. Program Focuses on "Wireless Power Transfer with Renewable Energy and IoT Integration," aimed at advancing electrical engineering innovations.

VINAYAKA CHAVITHI CELEBRATIONS

- On the occasion of Vinayaka Chavithi, On the final day, 31-08-2025, students from EEE, Food Technology, and Civil Engineering jointly participated in the Pooja. With IV B.Tech students leading the event, III, II, and I year students successfully organized and contributed to its smooth execution.

- Ch. Venkatesh (23021A0205), a III B.Tech student, was appointed as a member of the Internal Complaints Committee (ICC) from UCEK, JNTUK on 1st August 2025.

PHOTOGRAPHY

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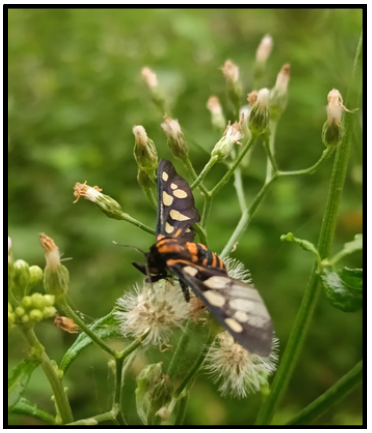

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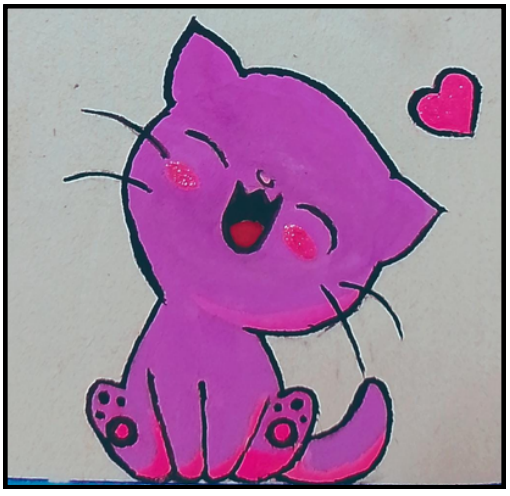

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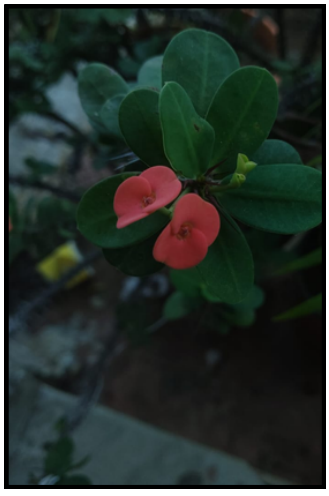

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The Spark

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