SD Association

SDA's First SD Express Students Project: A Success

Three winners selected from a full set of 14 interesting AI-at-edge-projects

By Yosi Pinto, Charman and President of the SD Association

The SD Association (SDA), the world's leading organization for developing and promoting SD memory card specifications, encourages new uses of its latest standard for memory cards — SD Express – the cards with the high-speed PCIe/NVMe interface. In cooperation with several prestigious universities from around the world, the SDA hosted the first SD Express Student Projects Competition.

Each participating student worked with the same development platform (NVIDIA Jetson Orin™ Nano Super Developer Kit, plus an M.2 to microSD Express adapter with a microSD Express memory card) and was challenged with developing an application utilizing the SD Express memory card. The subject of the application/project is completely at the discretion of the student and the university.

Best three projects were awarded prizes: $20k, $10k, and $5k and the first place winners get the opportunity to present their project at a trade show attended by the SDA.

The projects began during the Spring and Summer semesters and 14 out of 21 submitted their reports in September. the following 3 winners were announced by the dedicated judging[1] team after one month of a thorough evaluation:

1st prize: **"Remote PPG-based Vital Signs Monitoring"** by Shira Barmats and Shakedd Levi. Supervisor: Yair Moshe**.** Technion – Israel Institute of Technology

2nd prize: "**System for Real-Time Detection of Wildfires"** by Itay Hovav and Roy Cohen. Supervisor: Harel Yadid**.** Technion – Israel Institute of Technology

3rd prize: **"AI-Powered Edge Storage for Smart Cameras Using microSD Express Toward Smarter, Safer Crosswalks"** by Michael Patrini. Supervisor: Prof. Stefano Bregni. Politecnico di Milano

While the students had complete autonomy in choosing their subjects, the submissions were evaluated based on the following criteria (as defined in the competition rules):

[1] The judging team with their short bio is provided at the end of the article

(i) Highlights one or more advantages of using microSD Express technology supported by quantitative analysis (40%)
(ii) Incorporation of new technologies like AI/ML, AR/VR, robotics, gaming, etc. directed at new potential consumer markets or other mass market products for SD cards (20%)
(iii) Functioning project that can be demonstrated (10%)
(iv) Scientific value and impact (10%)
(v) Creativity and originality (10%)
(vi) Clarity of submission (10%)

Based on that criterion, we can see a few high-level observations and takeaways from all the submitted projects as follows:

1. **Use of SD Express:**
   Projects that treated the card as a core system enabler—not just storage—earned the highest marks. When SD Express was tied to measurable throughput or reliability improvements (e.g., medical imaging, wildfire detection, or AI model loading), the advantage was clear. Many submissions still viewed SD Express as "fast media" rather than a platform technology.
2. **AI Integration:**
   True AI integration with the card appeared in roughly half of the projects. The strongest cases used SD Express to handle serialized models, large sensor datasets, or edge-inference caching. Several others invoked AI nominally.
3. **Functioning Prototypes:**
   The difference between conceptual and real prototypes was striking. Teams that validated hardware and produced working demos scored higher.
4. **Creativity and Originality:**
   Student creativity was visible across universities, but it correlated strongly with clarity and focus. Overly broad idea collections underperformed compared to tightly scoped, demonstrable systems.
5. **Clarity and Documentation:**
   Clear, structured technical communication consistently elevated scores. Reports that included architecture diagrams, flow charts, and test results were easier to evaluate and scored higher.
6. **Educational Takeaway:**
   The competition succeeded in exposing students to high-performance removable storage and edge-AI challenges. Future student competition sessions could encourage deeper quantitative benchmarking of SD Express in real AI workloads to reinforce its technological importance. Also, more design tips for future users may be helpful to get the most of the cards (e.g., adding cooling to eliminate thermal throttling, providing more links/info on various test methods/tools etc.)

SD Association

Submissions

The complete abstracts of the winning projects and provided below along with a few quotes from the judges, followed by a link to the rest of the other submitted projects.

1st Prize - Remote PPG-based Vital Signs Monitoring" by Shira Barmats and Shakedd Levi

Abstract: We present a dual-mode system for contactless vital-sign monitoring from 1440p facial video using remote photoplethysmography (rPPG). Running on an NVIDIA Jetson Orin Nano Super Developer Kit, our prototype records the uncompressed stream to a microSD Express card while simultaneously executing a downscaled, low-latency pipeline for live feedback. microSD Express over PCIe/NVMe allows sustained 30 fps uncompressed 1440p capture, where legacy microSD solutions struggle to sustain comparable bandwidth, making high-fidelity offline analysis practical. On a 10-recording dataset against a Polar Verity Sense reference, our system achieved 8.3 bpm MAE in real-time and 6.6 bpm MAE offline, reflecting the accuracy gains unlocked by preserving uncompressed 1440p video for post-capture processing. By quantifying I/O throughput and end-to-end performance, and demonstrating a functioning system, we show that microSD Express is a key enabler for edge vision workloads in consumer telehealth and wellness applications.

Comments from the Judges: *"The split between real-time and offline processing demonstrates a good understanding of the required tradeoffs for embedded systems. The video demonstrating use of the system is appreciated. Comparison with a calibrated reference demonstrates good practice"; "This model shows it effectively maximizes the performance and features of the microSD Express card by enabling sustained 30fps uncompressed 1440p video capture and simultaneous low-latency processing on the Jetson Orin Nano platform. The high-throughput PCIe/NVMe interface allows reliable storage bandwidth that surpasses traditional microSD solutions, doing both real-time monitoring and high-accuracy offline analysis. The demonstrated MAE results validate the system's precision improvements enabled by lossless video recording. Overall, this implementation highlights microSD Express as a critical enabler for consumer-grade remote health and wellness edge AI applications, showcasing its robust I/O performance and system integration. It is very good model"; "Clear advantage of microSD Express usage with proofs was demonstrated - its relatively high performance video recording/reading enabled the full A\|I pipeline cycle. Nice application that can be practical and mass usage (remote medical). Very nice, clear and professional submission - like a scientific article"; "Well written"***.**

2nd Prize - "System for Real-Time Detection of Wildfires" by Itay Hovav and Roy Cohen.

Abstract: Due to climate change, the world continues to experience wildfires that are often not detected in time. Many existing solutions are bulky, expensive, or impractical, leaving us with the growing problem of small, manageable fires turning into large-scale disasters. Some of the approaches today are human watchtowers, which are labor-intensive and inefficient yet still in use, and satellites, which are weather-dependent and unable to detect small fires early enough. Our approach is to use edge devices for scalable and affordable wildfire detection. They are more practical than human sentinels and operate closer to the ground than satellites, giving them the ability to spot small fires as they begin. However, edge devices come with limitations: restricted RAM, modest CPU power, and slower memory. Running AI models on such hardware requires not only computational efficiency but also fast, sustained read/write performance to handle video streams and logging in real time. In this project, we demonstrate how microSD Express storage, combined with carefully selected AI models, can overcome these limitations and enable reliable, real-time wildfire detection.

Comments from the Judges: *"It is good that you have compared with a normal microSD card to see what the comparative performance is like in your performance graphs although it is difficult to infer too much from swap and ram utilization in Linux because of the sophisticated way Linux makes use of these resources. It is not clear if you are looking for fire (==flames) or precursors to fire (==smoke, heat effects such as shimmer) which would allow earlier detection of an anomaly, but it is recognised that your pipeline architecture is well suited to future extension to include new sensing techniques. No evidence of actual application of the developed system is provided except for one Lab use case"; "This model effectively shows the fact of that the high-speed read/write performance of the microSD Express to enable real-time, high-resolution wildfire detection with minimal latency. This shows the card supports simultaneous continuous video capture and AI inference while maintaining stability, matching the performance of larger SSDs. And Its compact form factor and energy efficiency make it well-suited for scalable edge AI applications. Overall, the microSD Express memory card's features are fully utilized, demonstrating strong potential for practical, real-time wildfire monitoring systems"; "Clear advantage of microSD Express usage with proofs was demonstrated, including AI usage (swap files used for inference stage). Proof of microSD Express advantage was done only in comparison with SSD… while showing that normal microSD might not work, could be better. An application that takes advantage of the removable card in wildfire detection remote systems – Nice and clear submission. References to resources could be better"; "Nice project. Keep up the great work".*

3rd Prize - "AI-Powered Edge Storage for Smart Cameras Using microSD Express Toward Smarter, Safer Crosswalks" by Michael Patrini.

Abstract: Urban mobility presents significant challenges for visually impaired people, particularly when crossing signalized pedestrian intersections. Ensuring safety and autonomy in these situations is crucial, and recent advances in computer vision and artificial intelligence enable the development of portable solutions capable of assisting users in real time. This work combines an AI-based detection system with modern storage technology to demonstrate how microSD Express can effectively support edge applications that demand both intensive computation and efficient data handling, and optimized power consumption, while simultaneously providing assistance to visually impaired people in safely crossing pedestrian intersections, thereby reducing risks and promoting greater autonomy in everyday urban contexts. The system provides real-time voice feedback to the user, announcing the traffic light status and the proximity to crosswalks, without requiring manual interaction. In parallel, a separate benchmarking campaign compared SD Express, microSDXC1, and M.2 SSD2 devices to evaluate storage performance and energy efficiency in edge AI workloads. The solution is completely stand-alone: it requires only a Jetson Orin Nano, a camera, and headphones, without needing dedicated infrastructure or modifications to traffic lights.

Comments from the Judges: *"The use of recorded data for system testing is good and demonstrates a sound understanding of the need for repeatable comparative testing. The provision of execution time and power consumption figures against realistic alternatives differentiates and is well appreciated and it is good that precise model numbers have been provided. Evidence of some real-world testing would have really rounded out the paper"; "This model shows a well-balanced use of microSD Express in edge AI deployment, leveraging its compact form factor, high throughput, and notably low and stable power consumption. As shown in the power profile, SD Express consistently maintains lower energy usage compared to other devices, which exhibit higher peaks and greater fluctuation. While slightly slower than M.2 SSDs, the card's result shows a significant advantage over standard microSDXC in both performance and efficiency. Its integration into a Jetson Orin Nano-based real-time pedestrian assistance system confirms microSD Express as a practical and scalable storage solution for power-sensitive embedded AI applications";" A smart edge camera AI based with pedestrian crossing detection for blind people. In parallel, a thorough SD Express benchmarking was done… but it is not so clear how the memory is used in the project - for video recording…for the AI? Clearly described but missing an order and better scientific reporting"; "…nevertheless it presented the pros/cons of SD Express relative to alternatives.*

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Abstracts of all submitted Projects for 2025

Total of 21 students from 6 highly rated universities from around the world joined the program in 2025. All the abstracts of the 14 projects that got to the finish line and submitted to the SDA by September 2025 can be downloaded from here .

Competition Judging Team:

- **Dr. Dave Marples** - Chief Scientist at Technolution BV, a Dutch technology company specializing in embedded and networked systems. With over 40 years of experience in embedded technologies—from the early days of the 6802 microcontroller to today's complex system architectures—he leads research and development in advanced embedded and communication systems. Before joining Technolution, Dr. Marples was CS in the Internet Architecture Research Lab at Telcordia (formerly Bellcore) in the U.S. He was co-founder of the IEEE Communications Magazine's "Home Networking / Networked Appliances" track, an early step toward the modern Internet of Things. He holds BEng and MEng degrees in Electronics, Computer and Communication Systems, and a PhD in Communication Systems from the University of Strathclyde. He is a Fellow of the OSGi Alliance and a former Honorary Professor at Stirling University, Scotland.
  Dave is an independent judge and is not involved in the SD Association
- **Mrudula Kanuri** – has 28 years of industry experience in building SoCs, networking and storage components. She is presently a System Architect at NVIDIA working on product definition and architecture for various Tegra SoCs that find applications in edge AI such as Notebooks, Robotics and Autonomous Vehicles. As the Chief Architect for several generations of SoCs and prior products, she has extensive system knowledge and expertise in all the SoC components including storage technologies required to judge this competition.
- **Ohki Shuichi -** Since the founding of the SD Association in 2000 to the present, he has served for over 25 years in various key positions including Board Director of the SD Association, inaugural Chairman of the Marketing Committee, and Chair of the miniSD Card specification for mobile application. From the association's inception, he has worked at Panasonic to promote the SD Association through numerous businesses including SD cards and SD hardware devices.
- **Yosi Pinto -** Senior Technologist at Sandisk + President and Chairman of the Board at the SDA
  With over 30 years of industry experience, he was a major contributor to the first SD Card standard, the first SD card controller development as well as a significant contributor to other memory products and standard evolution like Memory Stick and eMMC. He holds more than 100 patents related to memory cards. Pinto's expertise extends across electronic circuit design, chip design, leadership of development teams, management of large-scale projects and products, business development, and standardization operations. Served also as the Technical Committee chair of the SD Association last 10 years, including during the SD Express cards definition and as the Chairman of the Board of the SDA with around 800 member companies and board members from industry-leading companies. He holds MSc in Electrical Engineering from Stevens Institute of Technology (NJ, USA) with a major in Chip design and an MBA from Tel-Aviv University.