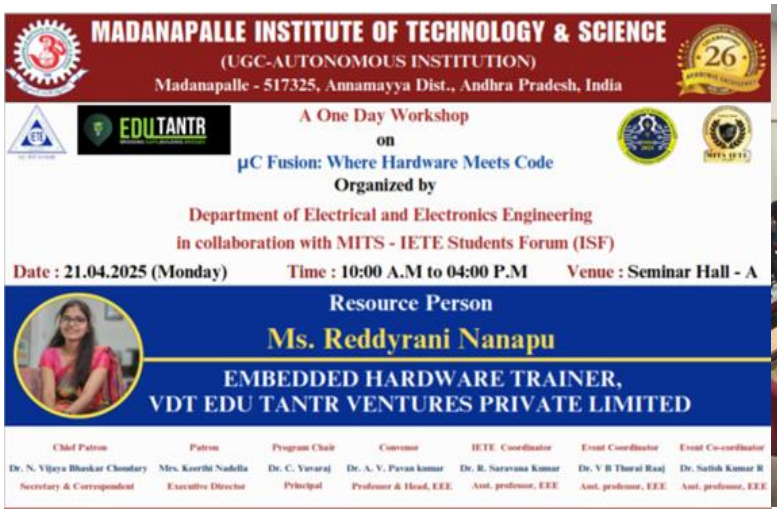
A Report on One-Day Workshop on "µC Fusion: Where Hardware Meets Code" Organized by Department of Electrical and Electronics Engineering In association with MITS-IETE Students Forum (ISF) on 21.04.2025



Report Submitted by: Dr. V.B. Thurai Raaj, Assistant Professor, Department of Electrical & Electronics Engineering.
Resource Person Details: Ms. Reddyrani Nanapu, Embedded Hardware Trainer, Vdt Education tantr Ventures Private Limited, Bengaluru.
Venue: Seminar Hall- A
Total Participants: 48 -Students and 5- Faculty Members
Report Received on 05.05.2025.
Mode of Conduct: Offline.

The MITS-IETE students Forum (ISF), Madanapalle Institute of Technology and Science, Andhra Pradesh**,** Madanapalle, in association with the Department of Electrical and Electronics Engineering, MITS, Madanapalle, organized a one-day technical workshop on **"µC Fusion: Where Hardware Meets Code"** on 21.04.2025. About 46 participants participated in this program, making the event a success.

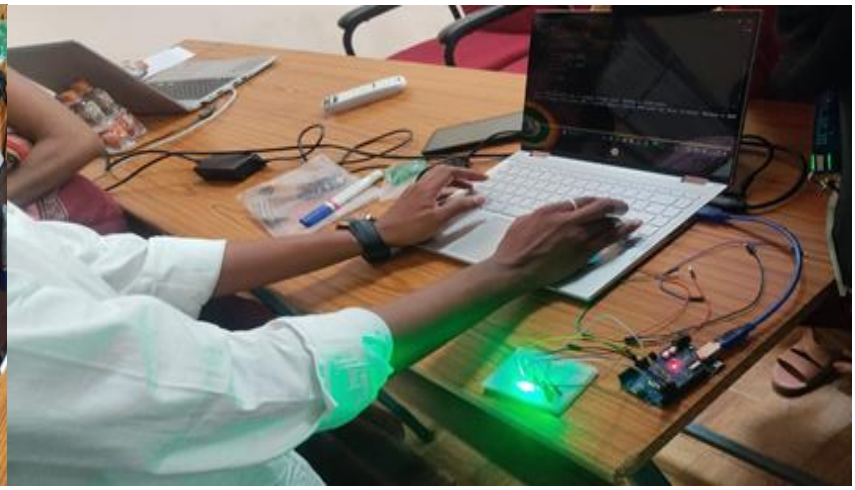
A summary of the skill development program is as follows:

Dr. A V Pavan Kumar, Professor & Head, Dept. of EEE, and Dr. R. Saravana Kumar, Coordinator, MITS-IETE students Forum (ISF), Asst. Prof./EEE, MITS, participated in the inaugural function. Dr. Sathis Ramoji, Assistant Professor in EEE, introduced the resource person. Dr. A V Pavan Kumar welcomed the resource person and addressed the importance of the training program and gave a brief introduction to this one-day technical workshop. Dr. R. Saravana Kumar inaugurated the program with his motivational speech and handed over the session to the resource person.

The 48 students from the third year, second year, and three faculty members from the Department of EEE have participated in this one-day technical workshop.

Training Sessions Overview:
A one-day offline workshop on ***µC Fusion: Where Hardware Meets Code*** was conducted on 21/04/2025 at Seminar Hall - A. The objective of the workshop was to provide participants with a comprehensive understanding of the foundational concepts and hands-on experience related to microcontroller-based system development. The event was structured into two sessions—morning and evening—catering to students from various engineering disciplines, all of whom had a keen interest in embedded systems, their design, and real-time applications.

- **Morning Schedule:** 9:10 AM – 12:10 PM
- **Afternoon Schedule:** 1:00 PM – 4:30 PM



Morning Session: Introduction to Embedded Systems

The morning session commenced with an in-depth introduction to Embedded Systems. The session began by explaining the definition, scope, and wide-ranging applications of embedded systems in modern technologies, such as the Internet of Things (IoT), automation, robotics, automotive electronics, and consumer electronics. The resource person elaborated on the unique characteristics of embedded systems, such as their dedicated functionality, real-time performance, and energy efficiency, differentiating them from general-purpose computing devices. This foundational understanding set the stage for a detailed discussion on the architecture of microcontrollers, with a particular focus on the Atmega328P microcontroller used in the popular Arduino Uno development board.

The morning session also covered the internal architecture of microcontrollers, including the Arithmetic Logic Unit (ALU), memory management (Flash Memory, SRAM), General-Purpose I/O ports, timers, and communication interfaces such as UART and SPI. Participants gained insight into how these microcontroller components work in tandem to execute real-time control tasks in embedded applications.

Embedded C Programming: Theory and Practice

After the theoretical introduction to embedded systems, the workshop progressed into a session on ***Embedded C Programming***. Participants were introduced to the syntax and structure of embedded C, learning how to write efficient and optimized programs for microcontroller-based applications. Emphasis was placed on directly manipulating hardware registers for configuring I/O ports, controlling digital pins, and reading analog values from sensors.

The session included practical examples of using embedded C to implement common embedded system operations such as generating delays, reading sensors, and controlling peripherals. The instructor demonstrated how to develop and debug programs using the Arduino Integrated Development Environment (IDE), covering the essential steps of compiling code, uploading it to the microcontroller, and performing serial debugging to monitor system behaviours.

Evening Session: Hands-On Training and Practical Implementation

The evening session focused entirely on hands-on training, where participants were divided into small groups and provided with embedded kits consisting of Arduino Uno boards, breadboards, jumper wires, various sensors (LM35 temperature sensor, IR sensor), and 16x2 LCD modules. The first practical task was to interface the LM35 temperature sensor with the Arduino Uno. The participants learned how to read analog temperature values from the sensor using the Analog-to-Digital Converter (ADC) and then display the measured temperature on the LCD. This activity allowed participants to understand the ADC's resolution and how to convert the analog voltage output from the LM35 to a corresponding temperature value in Celsius.

The second hands-on task involved interfacing a digital IR sensor to detect obstacles. Participants wrote embedded C code to process the input from the IR sensor and control an LED to indicate the presence of an object in front of the sensor. This practical exercise reinforced concepts such as digital signal processing, interfacing sensors, and using control statements in embedded programming. Additionally, participants gained experience in sensor calibration and signal conditioning, ensuring that the sensor worked reliably in different environments. Throughout both hands-on tasks, the instructor encouraged active participation, guiding the students through the debugging process, explaining common issues, and addressing questions related to timing constraints, sensor calibration, and system stability.

Conclusion

By the end of the workshop, all participants had successfully implemented embedded systems applications that involved both sensor interfacing and real-time data processing. The workshop concluded with a vibrant question-and-answer session, where students engaged in discussions about advanced topics in embedded systems, including real-time operating systems (RTOS), low-power design, and the role of embedded systems in industrial automation and smart technologies.

The feedback from the participants highlighted the effectiveness of the balanced approach between theoretical learning and hands-on practice. Many participants expressed their intention to pursue further studies and projects in the field of embedded systems, recognizing the potential of these technologies in both academia and industry.

In conclusion, the one-day embedded systems workshop successfully provided participants with a solid foundation in embedded C programming, sensor interfacing, and microcontroller-based system development. The workshop was an excellent starting point for anyone interested in furthering their knowledge and skills in the rapidly growing field of embedded systems.

The valedictory session of the one-day workshop on Embedded Systems was graced by the esteemed presence of Dr. A V Pava Kumar, Head of the Department of Electrical and Electronics Engineering (HOD/EEE), who delivered the closing remarks and highlighted the importance of embedded systems in modern technological advancements. Dr. Sathish Ramoji, Asst. Prof./ EEE, Dr. Saravana Kumar, Asst. Prof./ EEE and Mrs. Revathy Gopinath, Asst. Prof./EEE also shared their valuable insights on the growing relevance of embedded systems in academia and industry. Their encouragement and support provided immense motivation to the participants, and their remarks helped bring the workshop to a fitting conclusion. The session was a reminder of the significance of continuous learning and innovation in the field of embedded systems.

Overall Outcomes: -

1. Participants gained foundational knowledge of embedded systems and their applications in IoT, automation, and robotics.
2. They developed hands-on experience with microcontrollers, particularly the Arduino Uno, and learned to program in embedded C while interfacing various sensors and peripherals.
3. The workshop provided practical exposure to sensor interfacing, where attendees learned about ADC conversion and sensor calibration.
4. Participants enhanced their troubleshooting and debugging skills throughout the session, gaining confidence in problem-solving real-world embedded system challenges.
5. By the end of the workshop, they were inspired to explore further research and development in embedded systems, IoT, and automation technologies.

As an event coordinator, I expressed my gratitude to the Management and **Dr. C Yuvaraj,** Principal, for giving permission and financial support to organize this program. I thank **Dr. C. Kamal Basha**, Professor & Vice Principal- Administration, for providing the necessary needs in time and for his support. I thank **Dr. A V Pava Kumar**, Professor & Head of the Department of Electrical and Electronics Engineering (HOD/EEE), for his continued guidance in all the parameters. I take this opportunity to thank the entire **EEE faculty Members**, **Teaching, Non-Teaching staff**, and **students** for their involvement, support, and participation in this event.