**Summary of the Ethical RISC-V IoT Workshop at IIIT Bangalore**

**Introduction**

The “Ethical RISC-V IoT Workshop” held at IIIT Bangalore in collaboration with VLSI System Design (VSD) was a significant event that brought together innovative minds to explore real-world challenges in the fields of IoT and embedded systems. The workshop, conducted from May 9 to June 15, 2024, was designed as a structured educational competition, allowing participants to engage in hands-on learning, testing, and securing applications. The workshop culminated in a showcase of the top innovations and an award ceremony, celebrating the creativity and technical prowess of the participants.

**Workshop Structure and Levels of Competition**

The workshop was divided into three levels, each aimed at progressively enhancing the participants' understanding and application of RISC-V technology in IoT projects.

**Level 1: Building the Application**

In the first stage, participants were introduced to the RISC-V VSDSquadron Mini board, the primary hardware used in the workshop. This level focused on the basics of programming the board, understanding its architecture, and interacting with its components such as LEDs, push buttons, and various I/O connectors. The goal was to develop a functional application using the board, which would form the foundation for further challenges. This level ensured that all participants had a solid grasp of the board's capabilities and how to effectively utilize them in their projects.

**Level 2: Injecting Faults**

The second level introduced the concept of fault injection, an essential aspect of testing the robustness of embedded systems. Participants were required to intentionally introduce faults into their C code by manipulating voltage levels or clock signals. This process was facilitated by using an external board specifically designed for fault injection, simulating real-world scenarios where hardware might experience unexpected electrical disturbances. The ability to inject and manage faults was crucial for understanding how systems behave under stress and for developing strategies to mitigate potential issues.

**Level 3: Enhancing Security**

The final level of the competition focused on securing the applications developed in the previous stages. Participants were challenged to protect their applications against the faults introduced in Level 2. This involved implementing error-handling routines, creating redundant code paths, and possibly employing hardware-based security features available on the RISC-V board. The emphasis was on ensuring the reliability and security of the application, critical aspects in the development of robust IoT systems.

**Project Showcase**

The workshop saw the development of a variety of innovative projects, each addressing different aspects of IoT and embedded systems. Some of the notable projects included:

* **Fire Detection System**: A system designed to detect and alert in case of fire, providing an essential safety mechanism in residential and industrial settings.
* **LiFi Lock**: An innovative security system utilizing LiFi technology to ensure secure access control.
* **Water Level Indicator**: A practical application for monitoring water levels, useful in both domestic and agricultural environments.
* **LPG Gas Leakage Detector**: A safety device aimed at detecting LPG gas leaks, preventing potential hazards.
* **Error Detection and Correction System using Hamming Code**: Implemented on the VSDSquadron Mini board, this project focused on ensuring data integrity through error detection and correction.
* **Digital Clock with Alarm Functionality**: A basic yet essential application showcasing time-keeping and alarm capabilities.
* **Secure Lock Using VSDSquadron Mini**: A security project leveraging the features of the RISC-V board to create a secure locking mechanism.
* **Traffic Signal Automation System with Ambulance Detection**: A smart traffic management system designed to prioritize emergency vehicles.
* **Soldiers Health Monitoring and GPS Tracking System**: A system designed to monitor soldiers' health and track their location, crucial for military operations.
* **Smart Plant Care**: An IoT solution for monitoring and maintaining the health of plants, catering to both hobbyists and professional gardeners.
* **Colorimeter**: A device designed for color detection, applicable in various scientific and industrial processes.
* **Light Chase**: A project focused on creating dynamic lighting effects, showcasing the board's capability in handling visual output.
* **Morse Code Decoder**: An application designed to decode Morse code, highlighting the board's versatility in communication systems.
* **Obstacle Detecting Using the Infrared (IR) Sensor**: A project aimed at detecting obstacles, useful in automation and robotics.
* **Advanced Easy-to-use Burglar Alarm**: A security system designed to detect unauthorized access, enhancing safety in homes and businesses.
* **GasSense**: Another gas detection system focusing on various gases, providing a comprehensive safety solution.
* **IoT Health Monitor**: A project designed for remote health monitoring, showcasing the integration of IoT in healthcare.

**Participation and Feedback**

Out of 100 teams, 26 were selected to demonstrate their projects at IIIT Bangalore. The hackathon challenged participants to develop practical projects with real-world applications. The rigorous month-long journey was a test of both technical skills and creativity, as participants not only had to build their systems from scratch but also had to inject faults and protect their solutions against these faults.

The hands-on experience of coding directly into the RISC-V board was a unique and rewarding challenge for many participants. The involvement of experts like Prof. Madhav Rao, who provided invaluable insights and feedback, added immense value to the learning experience.

**Conclusion**

The Ethical RISC-V IoT Workshop was a resounding success, providing participants with a platform to explore the depths of IoT and embedded systems while addressing real-world challenges. The structured competition, spanning from basic application development to fault injection and security enhancement, offered a comprehensive learning experience. The innovative projects developed during the workshop are a testament to the participants' dedication and ingenuity. The event not only highlighted the potential of RISC-V technology in IoT applications but also underscored the importance of ethical considerations in developing secure and reliable systems.

**Pictures from Event:**

A person working on a computer

Description automatically generatedA group of people sitting in chairs

Description automatically generatedA group of people sitting on chairs in front of a large screen

Description automatically generatedA group of people standing around a sculpture

Description automatically generatedA group of people sitting at tables with laptops

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