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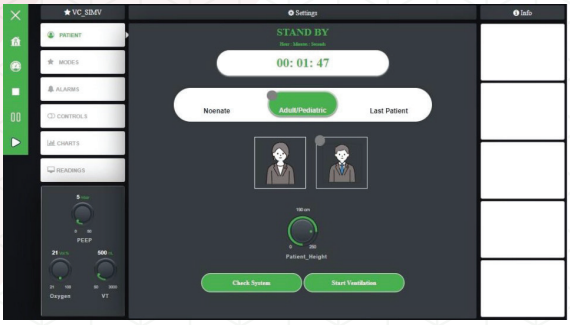
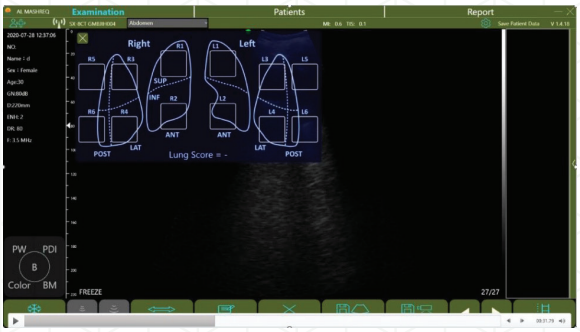
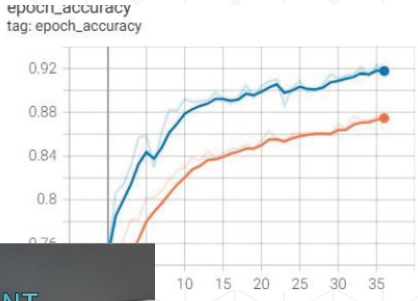
Ventilator with a smart ultrasound system to control ventilator parameters and monitor treatment response (Echo-Vent)

Al Mashreq medical care

Researchers from AL Mashreq Medical Care uses a ventilator that is integrated with other bedside technologies, using a control system that can transmit ventilator data to a computer system. The selection of mechanical ventilation mode should be personalized to ensure safety by optimizing ventilation-perfusion matching and the pressure-volume relationship of the lungs. Software architectures are developed, which allow flexible use of all ventilation and ultrasound parameters. It is equipped with an AI developed algorithm used for the Ventilated patients in the ICU to access the proper ventilation parameters and aiding in monitoring the treatment success by giving signs of adequate ventilation all of which are the key parameter of our system. Hospitals could use the insights provided by the AI to know how many patients will need a ventilator at specific times in the future, and plan their resources accordingly. All available data will be used in this Decision Support System as an aid to physicians to alarm in cases of lung infection leading to acute distress syndrome. The proposal aims to deliver a smart ventilator to be quickly manufactured locally with readily available parts worldwide to meet the demand for hospitals and government agencies in a cost-effective manner. “We developed a safe and affordable smart ventilator that can be manufactured quickly that can be used for emergency situations. The system set-up is completed and it will be provided with deep learning during the last phase, we hope to supply ventilators to meet the Egyptian demand in an internationally accepted version’ says Dr. Abou Bakr Mohammed Abd Alfatah Youssef Professor Emeritus at faculty of Engineering, Cairo University.





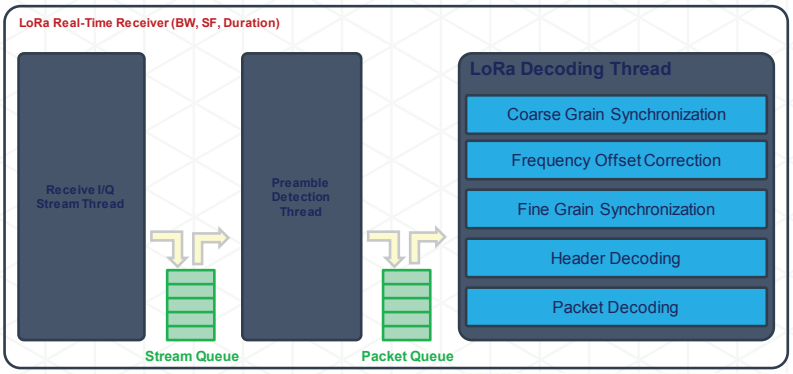


A Software Defined Radio-based LoRa Solution for Dense IoT Deployments within Smart Cities

The German University in Cairo and Smart Solutions for Technology Management

Researchers from the German University in Cairo and Smart Solutions for Technology Management has made significant advancements across three critical areas of long-range communication using LoRa technology and its associated Internet of Things (IoT) applications. These contributions not only extend the capabilities of LoRa systems but also demonstrate their potential in real-world implementations. In the first area, they have focused on enhancing the robustness and efficiency of LoRa communication through the integration of advanced error correction techniques. Specifically, they have employed Spatially Coupled Low-Density Parity Check (SC-LDPC) codes, which are influenced by the 5G-NR LDPC standards. These codes provide greater flexibility, efficient rate adaptation, and systematic encoding methods. As a result, they significantly improve the reliability and throughput of long-range data transmission, particularly in noisy or interference-prone environments. The second track of the project emphasizes the development of a comprehensive testing environment for LoRa technology. They have established a multi-gateway testing platform using Software-Defined Radio (SDR) devices, interconnected via a Virtual Private Network (VPN). This architecture is further supported by a centralized server responsible for data processing and analysis. This setup enables the implementation and evaluation of location determination algorithms based on Time Difference of Arrival (TDoA), facilitating high-accuracy geolocation for LoRa-enabled devices. In the third area, the testbed has been successfully leveraged to support a variety of commercial-grade IoT applications based on the LoRaWAN 1.1 specification. "Real-world use cases, including environmental monitoring, asset tracking, and e-paper signage, have been developed and deployed, showcasing the versatility and scalability of the proposed system architecture," says Dr. Tallal Osama Elshabrawy, Lecture and Associate Professor at the German University in Cairo. Read More

SDR Receiver Archirtecture



SDR Gateway Hardware

Experimental Testtbed Layout in GUC Campus

Deep Leaning-based Video Anomaly Detection Framework for Intelligent Transportation Systems

Benha University

Researchers from Benha University have developed a cutting-edge deep learning-based framework designed to enhance video anomaly detection for intelligent transportation systems. As Egypt and many countries transition toward smarter, AI-driven infrastructure, real-time monitoring of traffic environments and public spaces is critical for improving safety, ensuring compliance, and streamlining urban mobility. However, detecting abnormal or suspicious events from continuous video streams remains a complex task due to environmental variability, perspective changes, and the rarity of such events. To address this, the team proposed an unsupervised framework built upon Vision Transformers (ViT), employing a spatiotemporal encoder–decoder architecture. Unlike traditional convolutional methods, the transformer-based framework captures both local and global temporal-spatial dependencies across video sequences, making it highly effective for identifying subtle, rare, and complex behaviors. The framework's use of transformer-based self-attention enables it to adaptively learn patterns of motion and behavior, detecting anomalies without relying on human-labeled training data. This paves the way for deploying autonomous surveillance systems that scale effortlessly across environments—from pedestrian pathways to multi-lane intersections—enhancing response capabilities and reducing the burden on human operators. Its ability to generalize across heterogeneous environments to detect various abnormal events and behaviors without requiring supervision—makes it a scalable, flexible, and cost-efficient solution for modern smart surveillance. It has demonstrated high potential for integration into real-world settings where robustness, accuracy, and adaptability are crucial. "This project addresses a pressing need in modern urban infrastructure—real-time, automated video analysis. It represents a leap forward in intelligent monitoring systems by combining deep learning and transformer models to tackle complex, unstructured video data," says Prof. Dr. Lamiaa A. Elrefaei, Professor at Electrical Engineering Department, Faculty of Engineering at Shoubra, Benha University and the project PI.

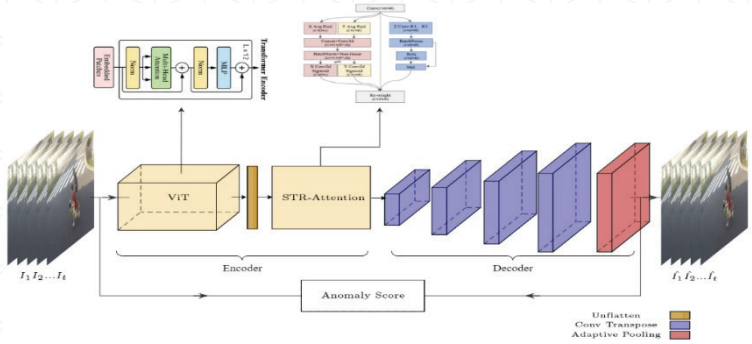


Fig. A: The Proposed Unsupervised ViT-based Framework

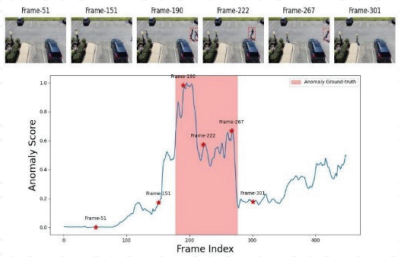


Fig. B: Detection of Stealing

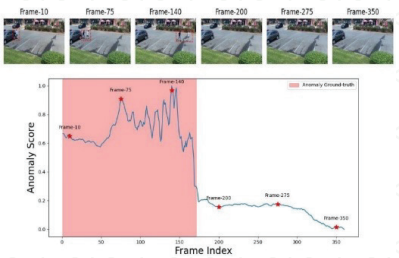


Fig. C: Detection of Fighting and Chasing

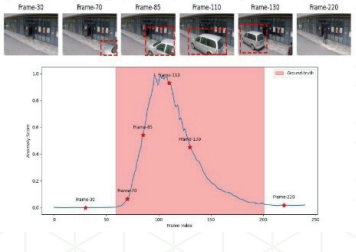


Fig. D: Detection of Car in Pedestrian Area

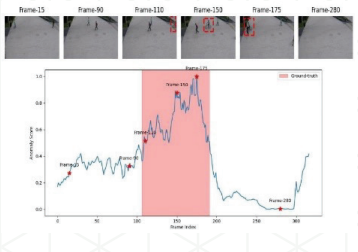


Fig. E: Detection of Bicycle in Pedestrian Area

A Modular Smart Mobile Robot Base Serving Multiple Use Cases

The British University in Egypt and Innovision Systems

Researchers at The British University in Egypt and InnoVision Robotics Company have developed a modular smart mobile robot base serving multiple use cases. Robots were traditionally used in complex, specialized fields, but today they have become reliable assistants in many day-to-day applications that require automation and serve purposes similar to humans—such as cleaning, delivery, and logistics. The proposed robot incorporates several novel features: Modular Design: Instead of building a different robot for each task, they designed a modular base that is cost-effective and structurally strong using advanced mechanical analysis. Human Interaction: The robot can interact with users through real-time voice recognition and image analysis. Autonomous Navigation: Leveraging both LIDAR and vision sensors, our robot can navigate autonomously, improving productivity and efficiency. “Thanks to its modularity, the robot can serve different purposes by simply changing the top functional module. At its core, the robot runs on scalable and optimized software, making it easily adaptable to a wide range of use cases. It can function as a disinfection robot using high-intensity ultraviolet beams, a delivery robot in a restaurant, or even a presenter in conferences—all using the same smart mobile base’ says Dr. Mahmoud Magdy Assistant Professor at The British University in Egypt. They also enhanced the robot’s mechanical structure by replacing iron components with stainless steel bars, resulting in a design that is both stronger and lighter. Additionally, they improved the navigation system for faster and more accurate path planning, and developed a voice-command interface for seamless human interaction.

A Transformer-based Framework for Detecting and Interpreting Code Clones

Port-Said University

Researchers from Port-Said University proposed a deep learning solution that leverages transformer models, which have demonstrated remarkable success in natural language tasks, to detect and classify code clones effectively. In software development, duplicating source code segments, known as code cloning, can enhance productivity but often leads to maintenance challenges and increased risk of defects. Detecting such clones is critical for maintaining software quality, especially as projects grow larger and more complex. The core innovation lies in combining multiple transformer-based models to capture both syntactic and semantic code structures, followed by a decision fusion network that improves prediction accuracy. Unlike traditional methods, the proposed solution offers interpretability by identifying clone types, thus providing developers with deeper insights into duplicated code. A prototype was developed, showing superior performance compared to state-of-the-art techniques in clone detection tasks. Key outcomes of the project include the development of a working prototype, empirical validation through extensive testing, and the publication of two research articles. “This work provides a valuable tool for enhancing software quality and aligns with the growing global and national focus on improving digital infrastructure and development practices’ says Dr. Rabab Abdel-Kader Associate Professor at Faculty of Engineering, Port Said University.

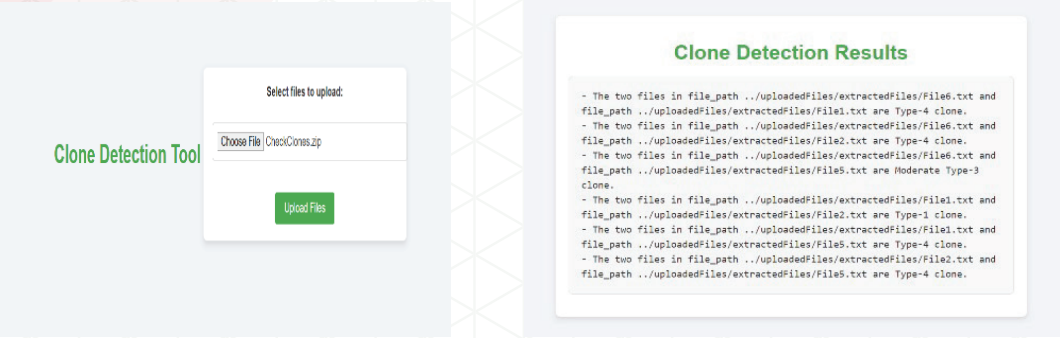


Figure 1. Screenshots illustrating the working prototype.

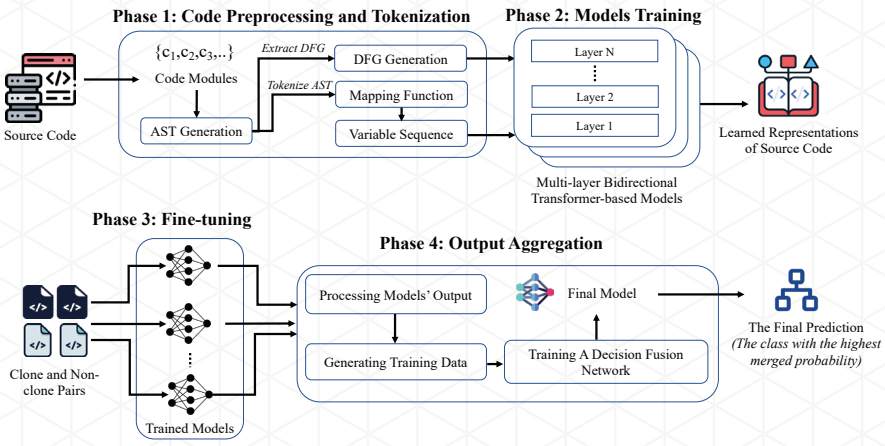


Figure 2. A Component Overview of the Proposed Framework