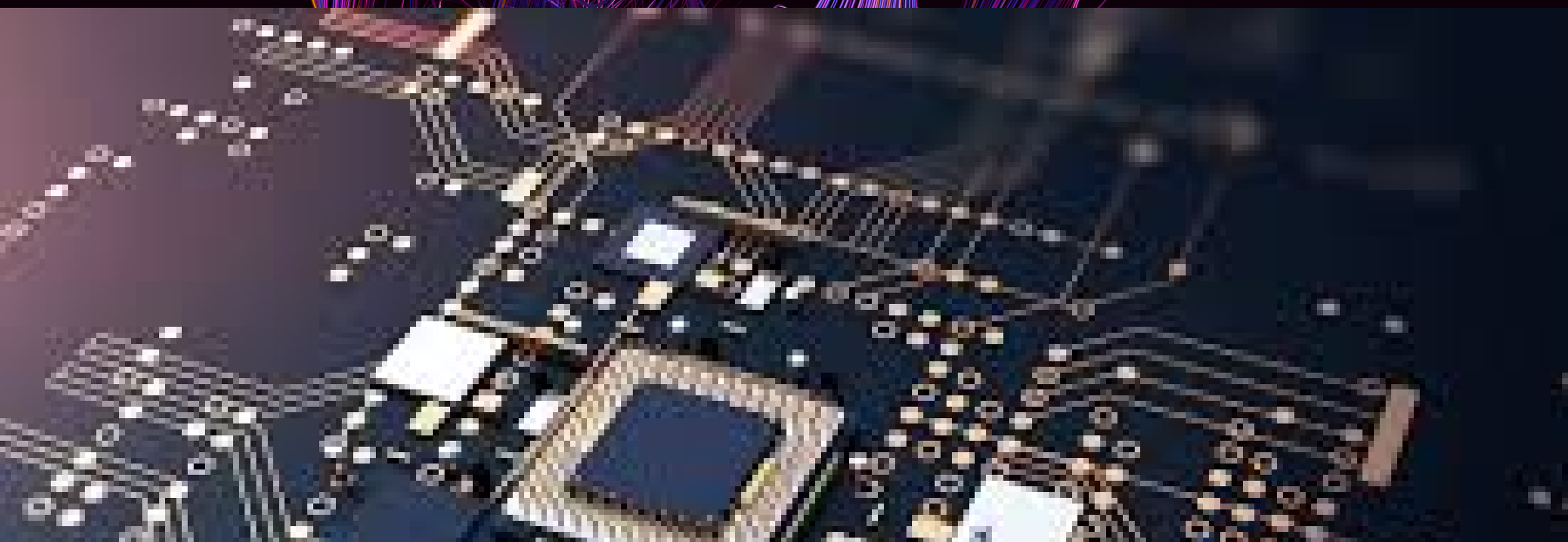
SRI VENKATESWARA COLLEGE OF ENGINEERING

(AUTONOMOUS)

Department of Electronics and Communication Engineering

RISE MAGAZINE

Recent Innovations In Sophisticated Electronics



DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

RISE-MAGAZINE

Recent Innovations In Sophisticated Electronics

EDITORIAL BOARD:

1 Dr. D Srinivasulu Reddy, HOD

2 Dr. K Lokesh Krishna, Professor

3 Mr. G Naveen Kumar, Asst. Prof.

4 20BF1A04F4- S Rithika

5 21BF1A04I5- P Sai Venkatnath

6 22BFA04275- G Muni Vignesh

STUDENTS:

1 22BFA04394- K Ushaswini

2 22BFA04407- P Divya

3 22BFA04415- R Rupesh

4 20BF1A04B6- K Bharathi

5 20BF1A04N9- U Hari Chandu

INSIDE THIS ISSUE:

1 AR and VR

2 AI everywhere

3 Extended Reality

4 FPGA-Based CNN for Eye Detection in an Iris Recognition at a Distance System

5 MCFP-YOLO Animal Species Detector for Embedded Systems

VOLUME 23 JULY-DEC. 2023

DEPARTMENT PROFILE

- Electronics and Communication Engineering has emerged as the major driving force in the present day Information Technology revolution. It is acting as a bridge between different disciplines of engineering and technology. It has penetrated into other prominent sectors such as health care, instrumentation, agriculture, automation, signal processing, remote sensing etc.., The recent developments such as IoT, Artificial Intelligence and the mercurial advancements in the field of communication.

Vision

- To be a focal centre for academic excellence in competing global standards and dynamics in the field of Electronics and Communication Engineering with research and services focusing on effective communication skills, entrepreneurial, ethical and social concern.

Mission

- To impart quality technical education in Electronics and Communication Engineering with well established infrastructure, state of the art laboratories, core instructions and cognizant faculty.
- To prepare the young and dynamic Electronics and Communication Engineers professionally deft and intellectually adept with knowledge, behaviour and information competency.
- To enable the learners for changing trends in the field of Electronics and Communication Engineering with a focus on career guidance, placements and higher education by Industry-Institute relationship.

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES

PEO1: Graduates should be cognizant in basic science, fundamental engineering stream along with core related domains in ECE and Allied fields.

PEO2: Graduates should understand issues related to design, problem solving, and intellectually adept with knowledge, behavior and information competency.

PEO3: Graduates should demonstrate their technical, communication, research, aptitudes along with leadership skills in professional environment to empower employability, higher education and entrepreneurs successfully through industry-institute interaction.

PEO4: Graduate should be motivated with high ethical, human values and team work towards development of the societ.

PROGRAM OUTCOMES

PO1: ENGINEERING KNOWLEDGE: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: PROBLEM ANALYSIS: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3: DESIGN/DEVELOPMENT OF SOLUTIONS: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4: CONDUCT INVESTIGATIONS OF COMPLEX PROBLEMS: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5: MODERN TOOL USAGE: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6: THE ENGINEER AND SOCIETY: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7: ENVIRONMENT AND SUSTAINABILITY: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: ETHICS: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: INDIVIDUAL AND TEAM WORK: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: COMMUNICATION: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: PROJECT MANAGEMENT AND FINANCE: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: LIFE-LONG LEARNING: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAM SPECIFIC OUTCOMES

PSO1: An ability to get an employment in Electronics and Communication Engineering field and related industries and to participate & succeed in competitive examinations like GRE, GATE,TOEFL, PSUs, etc.

PSO2: Should be able to design and test various electronic systems that perform analog and digital processing functions.

Augmented Reality (AR) and Virtual Reality (VR)

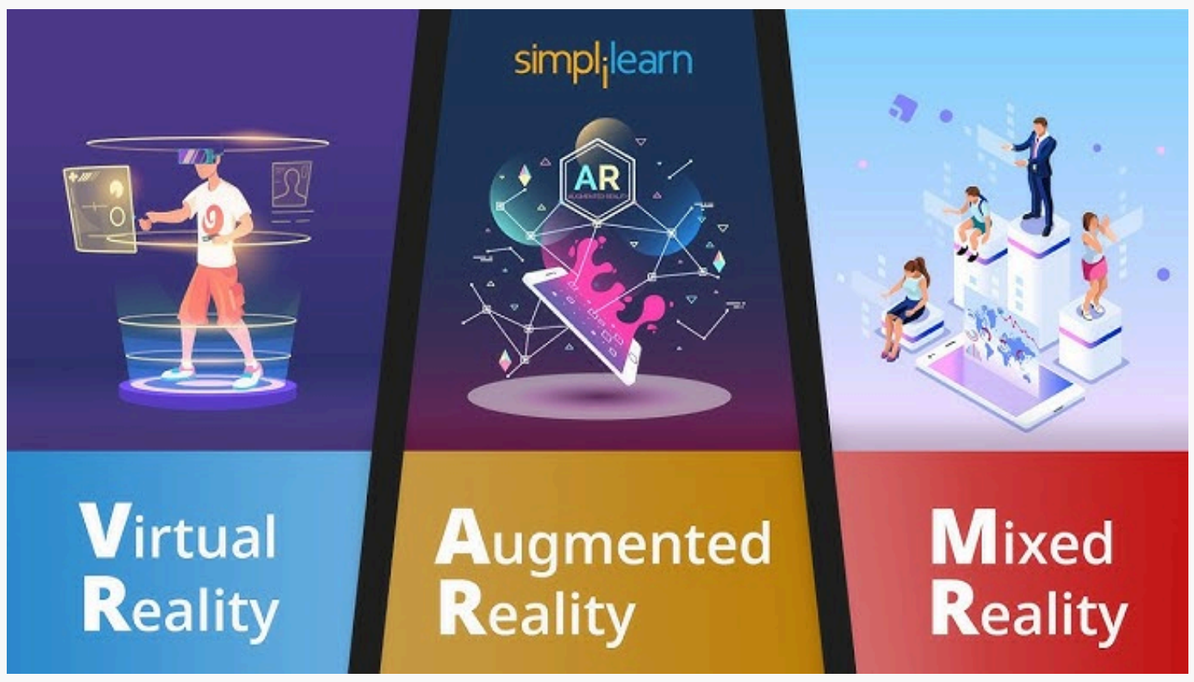
Online shopping platforms are progressively incorporating Augmented Reality (AR) and Virtual Reality (VR) technologies to improve customer experience and decision-making. This study examines the body of research from journals that are indexed by Scopus to investigate the significance, advantages, difficulties, and potential applications of Augmented Reality and virtual reality in online retail settings. The report provides insights into how these technologies are changing the e-commerce scene by synthesizing findings from other investigations.

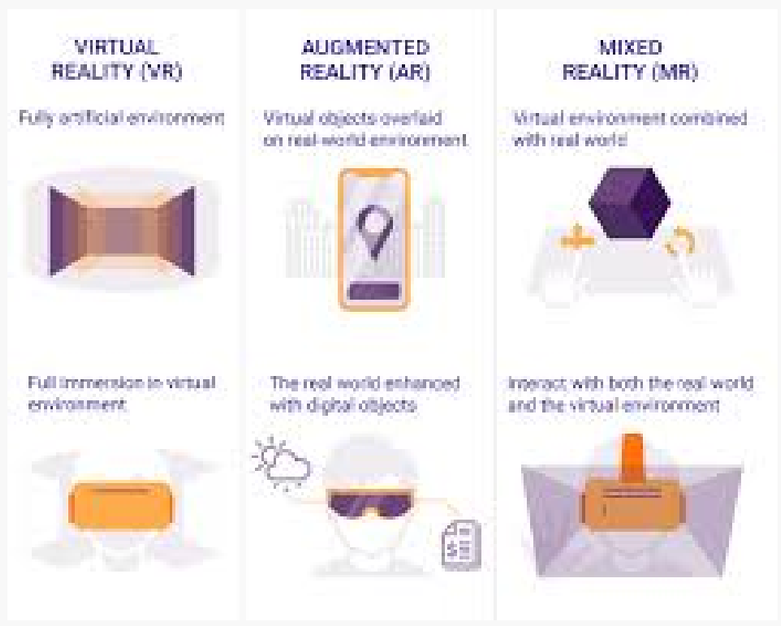
The earliest ideas and prototypes for AR/VR technologies appeared in the middle of the 20th century, and their history spans several decades. AR prefers digital data over the real world data, in contrast VR constructs fully immersive surreal worlds. Both technologies have uses in a variety of industries, such as online retailing, where they can improve the shopping experience by giving customers a more realistic and engaging way to see the products. Experienced merchants, who depend on rich sensory experiences to draw clients, such restaurants, fashion boutiques, and specialty stores, have been severely hit by the COVID-19 pandemic. Technologies like virtual reality (VR) and Augmented Reality (AR) emerged as possible ways to reproduce similar experiences as these retailers moved their operations online. Despite its potential, there is still a dearth of thorough instructions on how to integrate AR and VR in online business.

Since its beginnings in the mid-1990s, e-commerce has undergone substantial evolution, moving from simple online transactions to intricate systems incorporating social and mobile commerce. The use of the Internet as a platform for improving communication efficiency and as a marketing tool defined the early phases of e-commerce. With considerable advantages for both merchants and customers, e-commerce has grown over time to encompass both tangible and immaterial goods.

Emerging technologies like Virtual Reality (VR) and Augmented Reality (AR) are expected to revolutionize online retail. The use of AR and VR in online retailing is still restricted, despite early projections of its potential influence, because of significant technological obstacles as well as other difficulties. Methodology In this study secondary research methodology is used which includes reviewing literature from various journals of repute. Various gaps in the already conducted research were identified and were worked upon to find out buying of cosmetics especially through various online platforms. Study Objectives In order to close these gaps, the study looks into what motivates users to utilize Augmented Reality (AR) apps when they shop online, especially when it comes to cosmetics. The stimulus–organism–response (SOR) paradigm's constructs are used, and new elements like fit confidence, inventiveness, and social value are included.

The impact of Augmented Reality (AR) on online purchase intention and user experience in comparison to traditional web-based shopping is examined in the study Augmented Reality Versus Web-Based Shopping by Ebrahimabad, Yazdani, Hakim, and Asarian. The study looks at how Augmented Reality (AR) technology impacts consumer behavior, especially in developing nations, and improves shopping experiences. A thorough analysis of the function and effects of Augmented Reality (AR) applications in e-commerce, with a special emphasis on makeup products, can be found in the literature review of the research paper by Voicu et al. Online Shopping Behavior The popularity of online shopping has increased dramatically due to a number of factors, including accessibility, convenience, and technological developments. Online shoppers have differing opinions about it; some like it, while others value the time savings it offers. The experience with the internet, accessibility, and urbanization are all important factors that influence the way people shop online.





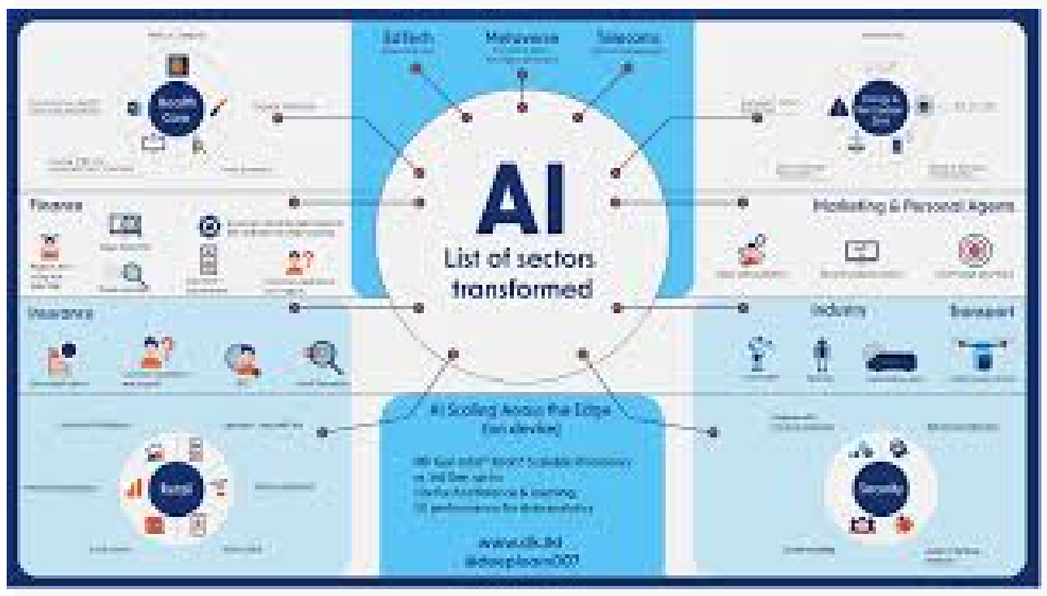
----------22BFA04394- K Ushaswini

AI everywhere

Artificial intelligence is the next stage of evolution. We are in an era in which we are surrounded by artificial intelligence knowingly or unknowingly. In this paper, we have discussed the overview of artificial intelligence starting from its history, goal, types, branches, applications to its misuse and threats. Artificial Intelligence has seen an immense progress in recent years. This progress is a result of various endeavours and diligent work contributed by many industrious scholars, mathematicians, analysts and various researchers. Artificial Intelligence (AI) technology can play an imperative role in economic development, resource conservation, and environmental protection by increasing efficiency. This paper gives us a better understanding of the field of Artificial intelligence and can be helpful in pursuing any branch of the same.

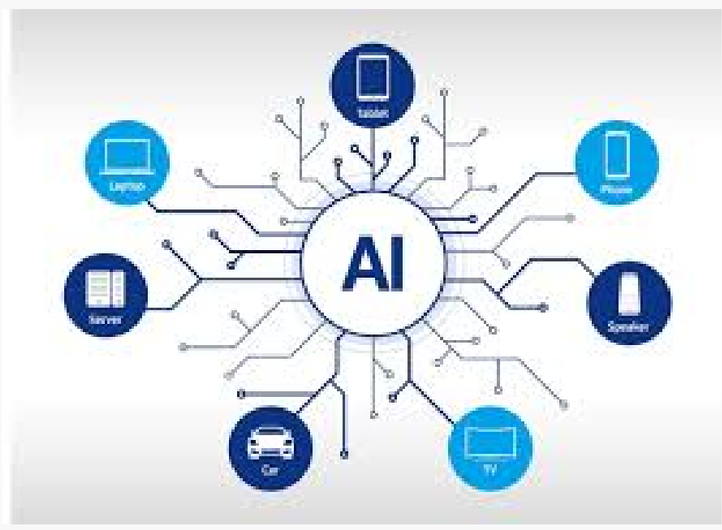
In the first half of the 20th century, science fiction helps the world to make familiar with the concept of artificially intelligent robots. But going on further first we should discuss what is artificial intelligence. According to the father of Artificial Intelligence, John McCarthy, artificial intelligence is "The science and engineering of making intelligent machines, especially intelligent computer programs". Artificial Intelligence can be defined as "Developing computer programs to solve complex problems by applications or processes that are analogous to human reasoning processes".

By the time of the 1950s, we had a generation of scientists, mathematicians, and philosophers with the zeal of Artificial Intelligence (or AI). One such person was Alan Turing, even though the term artificial intelligence was not coined at that time, he was already thinking what if machines can solve the problems as the humans do or possibly even better.



The ‘final’ goal of artificial intelligence is to create an intelligent machine which is capable of reasoning, planning, solving problems, thinking abstractly, comprehending complex ideas, learning quickly and learning from experience. In practice, this emulated intelligence is to reflect a broad and deep ability to fathom its surroundings so as to figure out what to do in infinite possible situations. In order to manage problems optimally, it needs to be able to execute creativity in its functioning. All of the stated properties are assigned to the long-term goal of AI studies – general intelligence. However, in order to achieve such a goal, scientists have to focus on a vast variety of complex concepts that are its building blocks, both individually and in correlation.

Since Artificial Intelligent is expanding its horizons, It can also facilitate hackers and intruders to organize attacks easily, Hackers could easily take help of such AI system to seize control of many types of equipment such as Drones, Missile or self-driving cars which can be turned into potential weapons. Traditionally, it takes a lot of time and man-effort to plan a Cyber-Attack, but these artificially intelligent systems can make such jobs quite easy. AI has also made Phishing more effective than ever, One can figure out the pattern of user behaviour on various Social Networking Sites, and find where the user is most vulnerable and what are the areas in which users their guard down. And such areas can be bombarded with phishing Links which would finally tempt them to click on such links.



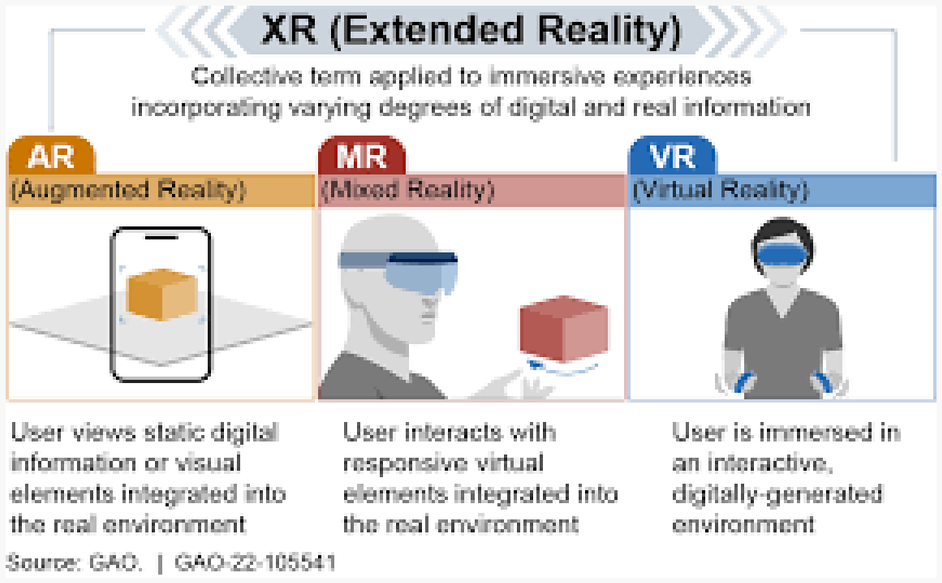
One of main feature of AI is that we just have to feed the destination, and it can use Machine Learning to figure out the path to reach there. But this also poses a threat, though we have programmed the System for a good purpose there is a possibility that the system would use devastative paths to achieve its Goal. AI can very efficiently be used to make more accurate predictions about various cosmic activities and phenomenon, We can use AI to find answers of numerous mysteries of our Universe that we know so little about. ----------22BFA04407- P Divya

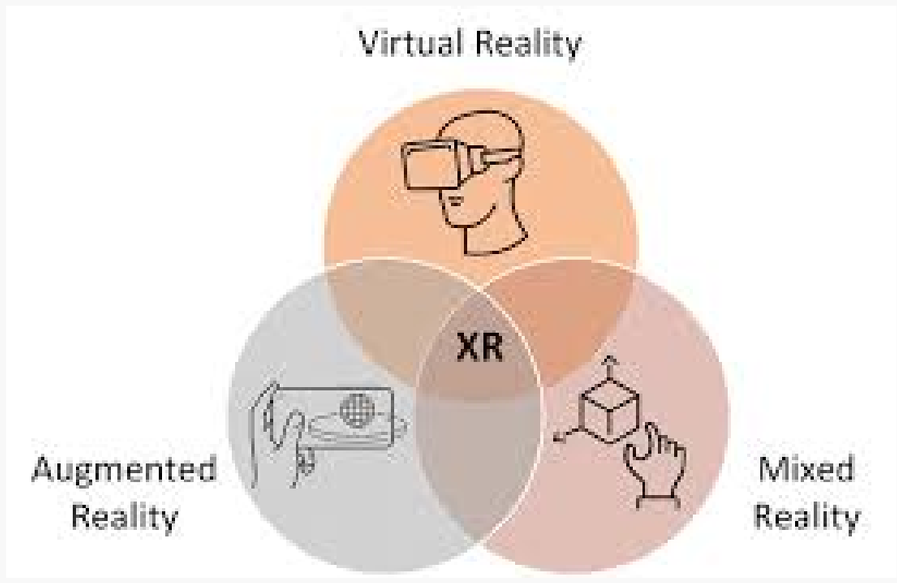
Extended Reality

In 2016, Niantic released Pokémon Go, an augmented (AR) reality video game for mobile devices. By overlaying creatures and game mechanics on top of the live camera feed from the mobile device, and connecting devices to each other, Pokémon Go gave many people their first commercial experience of extended reality (XR), highlighting its social, interactive, and artistic potentials. XR also includes Virtual Reality (VR) and Mixed Reality (MR). XR changes how we perceive and interact with the world around us. It has made an impact in construction, medical, entertainment and exploration industries, amongst many others. The latest cycle of research and devices, from the metaverse to Apple's latest Vision Pro headset, has attracted substantial investments and equally creative engineers. But where do these tools come from, and how can we engage with them from a critical perspective?

XR or "Extended Reality" is an umbrella term used to describe technologies that blend digital experiences with physical reality. While many innovative XR technologies are becoming increasingly mainstream, some of the ideas underlying VR and AR technologies can be traced back to the 1800s and stereoscopic displays, which play with vision. These early devices made it possible to capture and represent the world in 3D images using mirrors and refracting prisms. The Crash Course: Future of VR episode has a more detailed look at the history of VR (video includes transcript).

Technologies that fall under the term XR provide us with a more immersive way to interact with digital objects. What do AR, VR, and MR mean? In healthcare, VR helps people get in the shoes of people who perceive the world in different ways or to prepare patients for medical procedures. In retail, brands have, like Ikea, used AR or VR to let curious customers "try out" products before purchasing. In digital arts, some people have reoriented their career towards exploring the artistic potential of these tools, creating immersive experiences, compositions, games, etc.





Virtual Reality (VR) usually relies on a head mounted display with screens for each eye. This allows content creators to generate “stereoscopic” video which translates into a three-dimensional experience. VR devices can immerse a user in real-world 360 video, computer-generated content, or a combination of both; these are usually controlled by handheld remotes. Examples of VR include the video game Second Life, the Mozilla Hubs platform of virtual rooms, or, in fiction, the Star Trek Holodeck. With Augmented Reality (AR) experiences, digital content is layered on top of the physical world using headsets, smartphones or wearables. With AR, the wearer’s environment can be augmented with text, images, video, sound, and other forms of haptic feedback just like in Pokémon Go. Other examples include Tiktok’s animated overlays, or Ikea’s app which helps you visualize furniture in a room before buying it. The defining feature of Mixed Reality (MR), and what differentiates it from AR, is that objects in the physical world and digital content coexist and interact with each other, and with you! For example, Google Translate can overlay translated text over real life script. If you change what is written, the translation will update. Generally, XR can be thought of as any system which blurs the lines between what is real and what is computationally simulated by making the latter interactive and immersive.

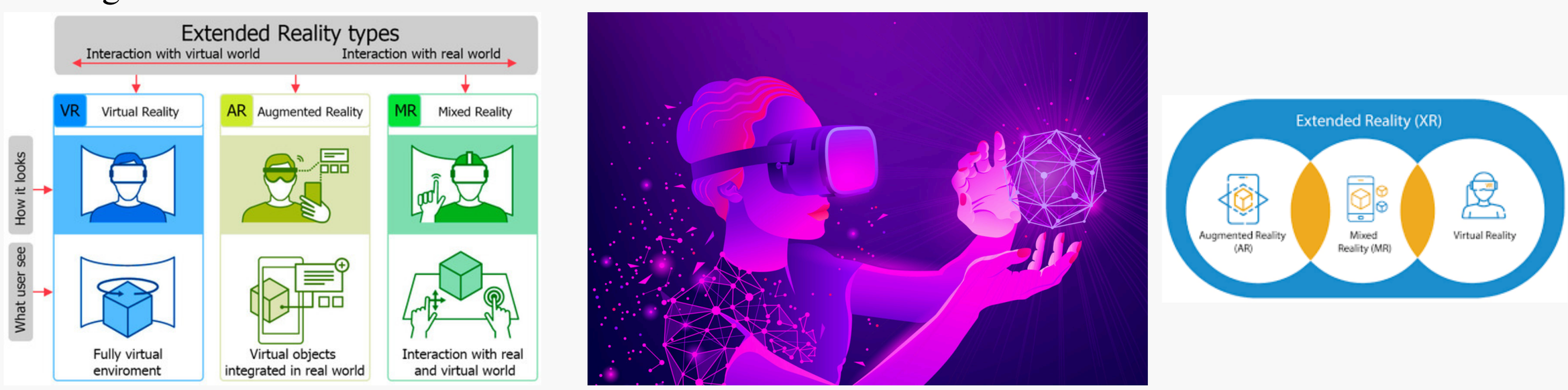


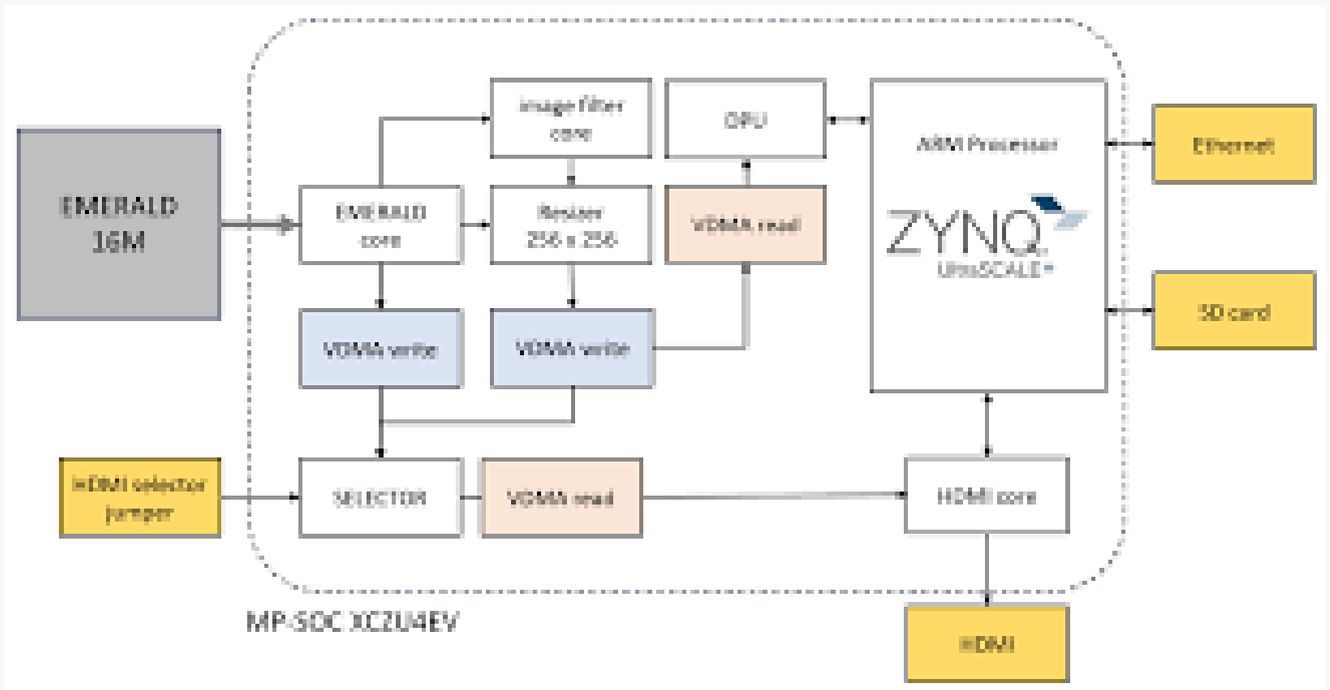
Image text: A graphic with text summarizing the differences between the technologies designated as XR: Augmented Reality (with a graphic showing how a cup rendered through a tablet is displayed with a digital speech bubble) is when digital designs get displayed over a user's environment but aren't interactive. AR is a way to show digital information about an environment. Virtual Reality is when a user's environment is replaced by a digitally rendered environment. VR is generally intended to be an immersive experience using sight and hearing. This text is accompanied by a graphic of a person with short hair in a black shirt with a head mounted display and a stylized rendering of a 360 environment around them.

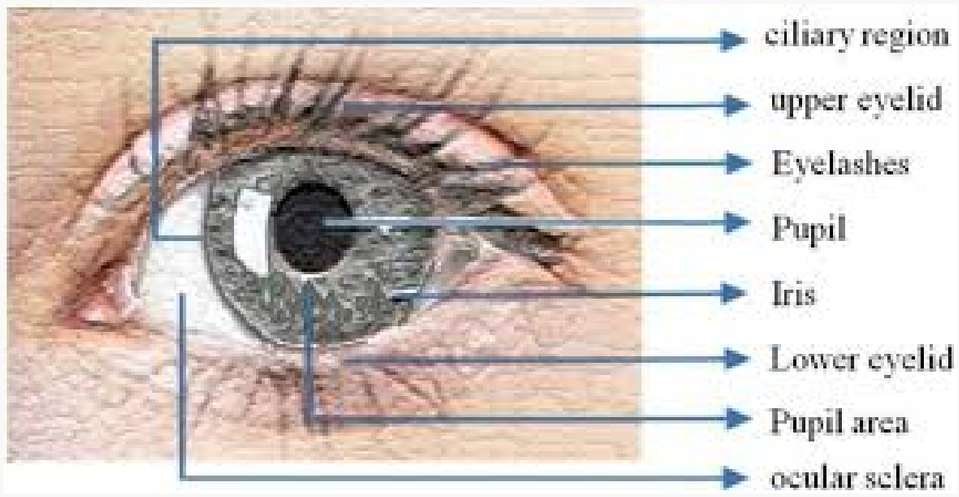
----------22BFA04415- R Rupesh

FPGA-Based CNN for Eye Detection in an Iris Recognition at a Distance System

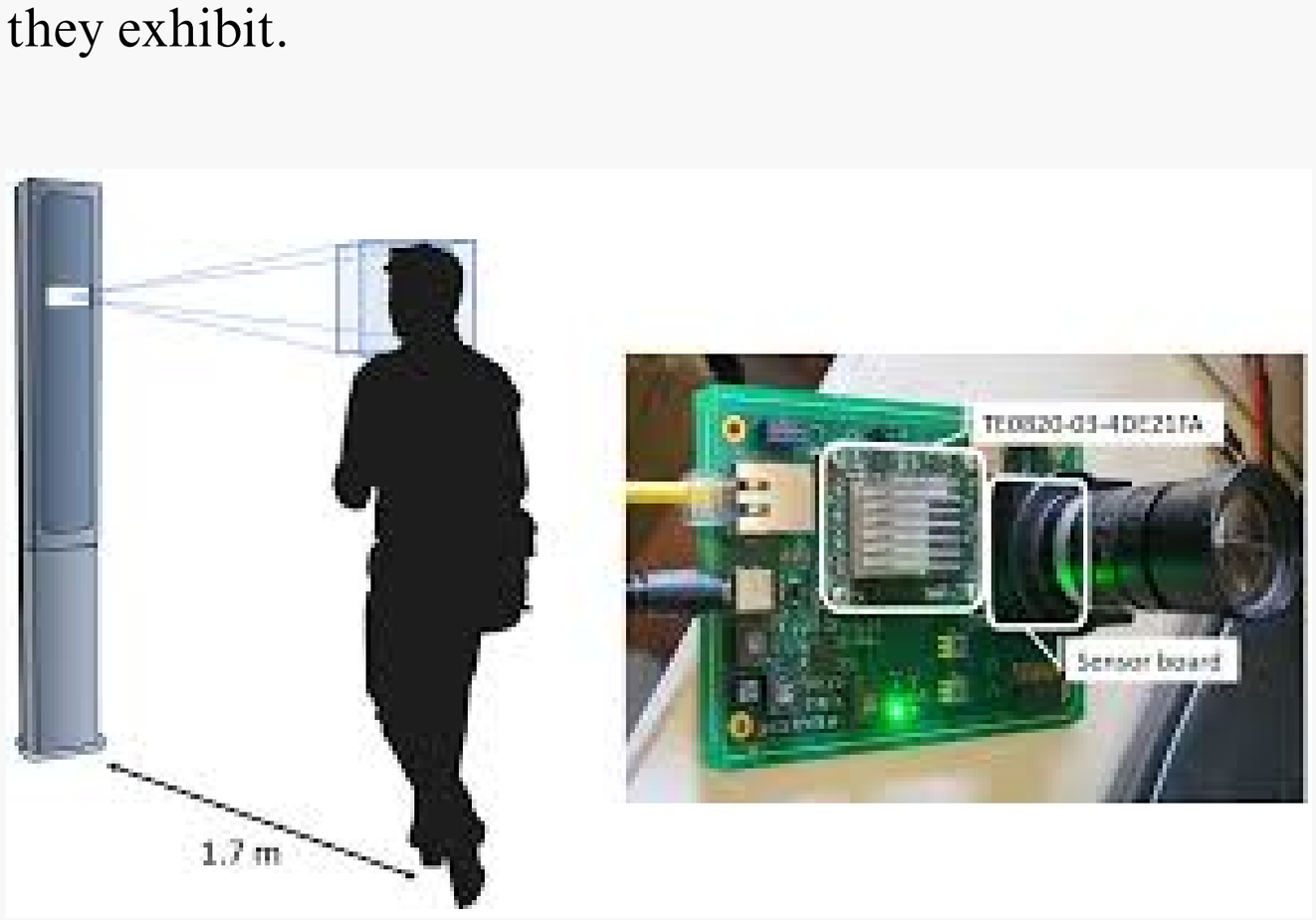
Neural networks are the state-of-the-art solution to image-processing tasks. Some of these neural networks are relatively simple, but the popular convolutional neural networks (CNNs) can consist of hundreds of layers. Unfortunately, the excellent recognition accuracy of CNNs comes at the cost of very high computational complexity, and one of the current challenges is managing the power, delay and physical size limitations of hardware solutions dedicated to accelerating their inference process. In this paper, we describe the embedding of an eye detection system on a Zynq XCZU4EV UltraScale+ multiprocessor system-on-chip (MPSoC).

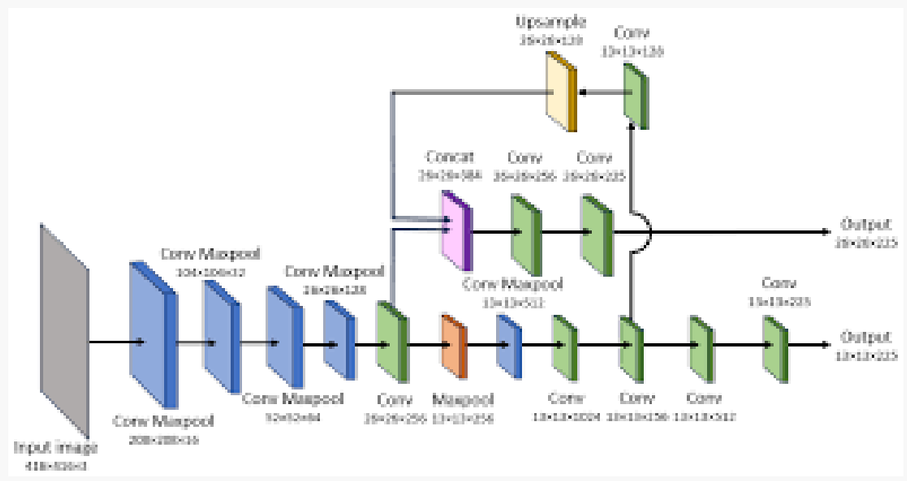
In this proposal, the network will be trained only with correctly focused eye images to assess whether it can differentiate this pattern from that associated with the out-of-focus eye image. Exploiting the neural network's advantage of being able to work with multi-channel input, the inputs to the CNN will be the grey level image and a high-pass filtered version, typically used to determine whether the iris is in focus or not. The complete system synthetises other cores and implements CNN using the so-called Deep Learning Processor Unit (DPU), the intellectual property (IP) block released by AMD/Xilinx. Compared to previous hardware designs for implementing FPGA-based CNNs, the DPU IP supports extensive deep learning core functions, and developers can leverage DPUs to conveniently accelerate CNN inference. Experimental validation has been successfully addressed in a real-world scenario working with walking subjects, demonstrating that it is possible to detect only eye images that are in focus. This prototype module includes a CMOS digital image sensor that provides 16 Mpixel images, and outputs a stream of detected eyes as 640 × 480 images. The module correctly discards up to 95% of the eyes present in the input images as not being correctly focused.

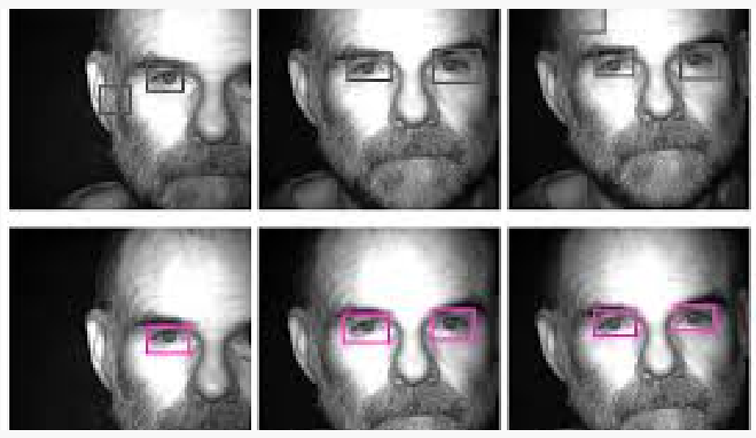




Due to their exceptional performance, convolutional neural networks (CNNs) have emerged as the state of the art in recent years for image recognition, object detection, image segmentation and many other applications, rapidly replacing traditional computer vision methods. In brief, a CNN is a type of feedforward neural network that is distinguished by its ability to extract the most relevant features for the task to be solved from the data utilising convolutional structures. Due to the advantages they provide, such as local connection, weight sharing and dimensionality reduction by sampling, these types of networks have become extremely popular in research and industry scenarios. Nonetheless, despite their excellent performance, the high computational complexity associated with CNNs may pose a hindrance to their use in applications where power consumption or device size/weight are limiting factors. For example, for the inference of a small image (244*244), a large CNN may require around 40G of multiplication or addition operations. The most popular solution for handling such complexity is to employ graphics processing units (GPUs), and make use of the degree of parallelism they exhibit.



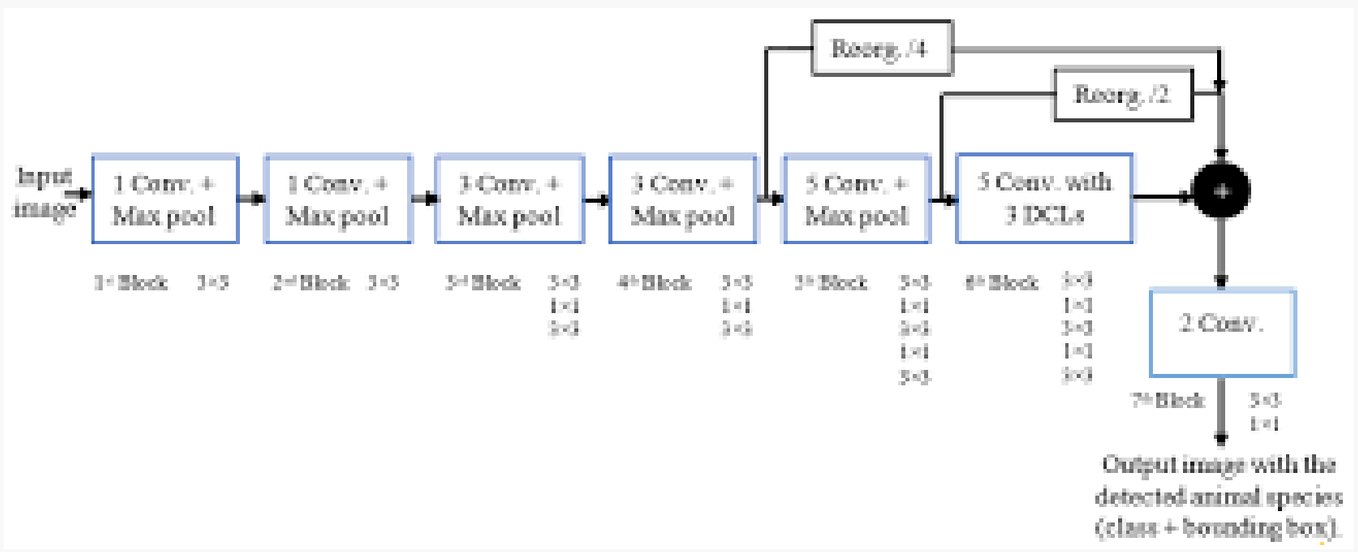


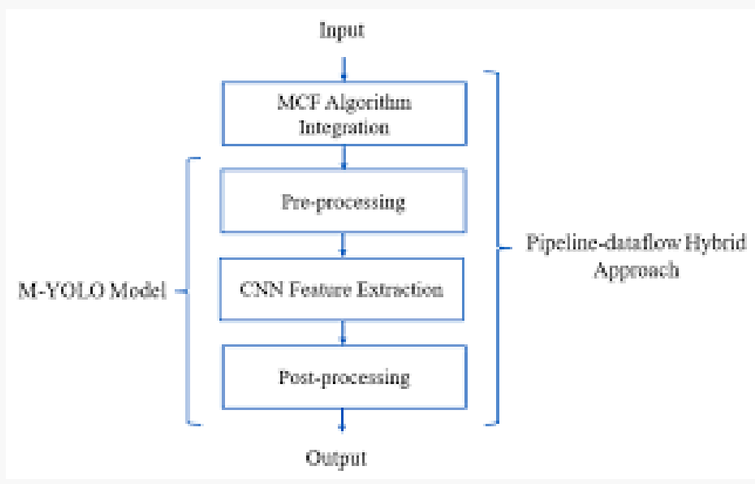


Future work aims to embed the later stages of the iris recognition system (iris segmentation and normalisation) in the MPSoC. Regarding the eye region detection system, the next steps will involve training the network using images captured by the system itself, and evaluating the possibility of using a DPU that processes more multiply accumulate operations (MACs) per clock cycle (B2304 or B3136), for a faster network, which could work with image sensors that provide more images per second than the one currently deployed in the system.---------- **20BF1A04B6- K Bharathi**

MCFP-YOLO Animal Species Detector for Embedded Systems

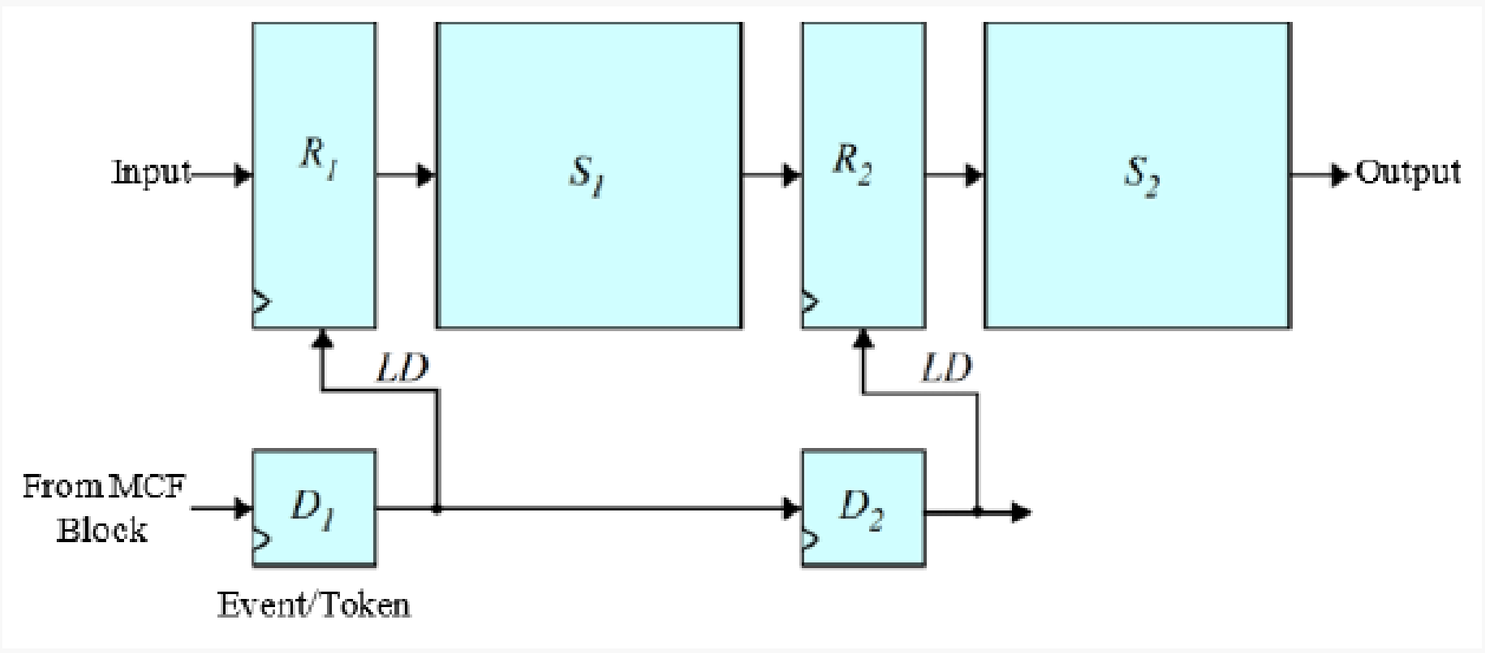
Advances in deep learning have led to the development of various animal species detection models suited for different environments. Building on this, our research introduces a detection model that efficiently handles both batch and real-time processing. It achieves this by integrating a motionbased frame selection algorithm and a two-stage pipelining–dataflow hybrid parallel processing approach. These modifications significantly reduced the processing delay and power consumption of the proposed MCFP-YOLO detector, particularly on embedded systems with limited resources, without trading off the accuracy of our animal species detection system. For field applications, the proposed MCFP-YOLO model was deployed and tested on two embedded devices: the RP4B and the Jetson Nano. While the Jetson Nano provided faster processing, the RP4B was selected due to its lower power consumption and a balanced cost–performance ratio, making it particularly suitable for extended use in remote areas.





For the safety of wildlife and humans, it is crucial that mitigation systems for wildlife–vehicle collisions (WVCs) and wildlife–human conflicts (WHCs) detect wildlife in real time. Therefore, the delay between when the wildlife first appears in the image and its detection should be enhanced, particularly on low-power machines with limited computational capabilities, such as embedded systems. Deploying deep learning-based animal detection models on embedded devices and reducing the processing delay, which is crucial for real-time applications, poses challenges due to their power constraints. Wang et al. offer insights into the development of lightweight models for avian species. Additionally, techniques like pruning and quantization have been employed to compress the CNN models and reduce computational workload, making them suitable for deployment on embedded devices.

These studies align with our objective of reducing the detection delay. However, instead of refining neural network architectures as carried out in other studies, we examine the neural network inference system from a system's perspective, targeting the elimination of processing delays. Our aim in this paper is to enhance the processing speed for a given neural network architecture without redesigning the architecture itself. Other studies have explored the use of Field-Programmable Gate Arrays (FPGAs) for hardware acceleration. However, programming them can be complex as it requires knowledge and expertise in hardware programming and optimization. In addition, FPGAs are known for their high power consumption, making power management a critical consideration during their deployment. Minakova et. proposed the concurrent use of task-level and data-level parallelism to run CNN inference on embedded devices. This approach ensures high-throughput execution of CNN inference, allowing for optimal utilization of the NVIDIA Jetson, which achieves 20% higher throughput compared to standalone CNN inference.



The proposed MCFP-YOLO detector was deployed on both the RP4B and NVIDIA Jetson Nano devices to evaluate its efficiency in terms of processing speed and power consumption. This evaluation was conducted using FPS, current consumption (mA), and CPU utilization (%) metrics for real-time processing from a web camera feed. The RP4B features a Quad-core Cortex-A72 64-bit, 1.5 GHz CPU, and a VideoCore VI 3D 500 MHz GPU. It can support up to 8 GB of SDRAM and uses a microSD for storage. RP4B has a two-lane camera port, HDMI and Display Port, and four USB ports. Additionally, the RP4B supports Gigabit Ethernet, Bluetooth 5.0, and 2.4/5 GHz Wi-Fi for connectivity. Similarly, the NVIDIA Jetson Nano, another embedded device, includes a Quad-core Cortex A-57 64-bit, 1.43 GHz CPU.

------20BF1A04N9- U Hari Chandu