RESEARCH ASSOCIATION OF MASTERS IN ENGINEERING

ICRAIC 2K25 CONFERENCE PROCEEDINGS

3RD INTERNATIONAL CONFERENCE ON ROBOTICS, AUTOMATION AND INTELLIGENT COMPUTING

FEBRUARY 15, 2025

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https://rame.org.in/

ICRAIC 2K25

Conference Proceedings

3rd International Conference on Robotics, Automation and Intelligent Computing

15th February 2025

Editors

Dr. Manoj A. Kumbhalkar

Dr. Radheshyam H. Gajghat

Dr. Jagdish D. Kene

RESEARCH ASSOCIATION OF MASTERS IN ENGINEERING

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This is the Abstract book of the 3rd International Conference on Robotics, Automation and Intelligent Computing (ICRAIC 2K25) held on 15th February 2025 was organized by Research Association of Masters in Engineering, India.

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PREFACE

Research Association of Masters in Engineering is committed to providing a peer reviewed platform to outstanding researchers to exhibit their findings for the furtherance of technology to provide a research forum. We are devoted to continual innovation to better support the wishes of our communities, making sure the integrity of the research we publish, and championing the importance of open research.

ICRAIC 2k25: 3rd International Conference on Robotics, Automation and Intelligent Computing focused on the development and integration of robot, digitalization, automation, and AI technologies, inviting well-known experts and scholars at home and abroad, as well as scientific researchers and industry practitioners in the field of intelligent control, to jointly discuss the cutting-edge technologies of robots and their new applications in different industries, and build a robot innovation ecosystem. ICRAIC 2K25 aimed to showcase state-of-the-art methodologies and technologies in Engineering and Technology. It focused on new ideas and paves the way to disseminate the latest innovations and practices. It facilitates opportunities to network, collaborates, and exchange ideas with renowned leaders, scientists, and researchers in Robotic, Automation and Intelligent Computing. It acts as a crucial platform for industry and academia to foster innovative ideas, theories, frameworks, and applications. ICRAIC 2K25 was encouraged recent and futuristic advancements, challenges, and new strategies in the frontiers of Robotic, Automation and Intelligent Computing.

Dr. Rakesh Himte, Principal, Vidyavardhini's College of Engineering & Technology, Vasai, Maharashra, India was the Chief Guest of the conference and delivered inaugural address. Dr. Rudrarup Gupta, Faculty, Tagore School of Rural Development and Agriculture Management, University of Kalyani, Guest Lecturer, Faculty of Agriculture, JIS University, Founder, Skill Development Interface, Kolkata, India was the Distinguished Speaker of the conference and delivered a key-note address on "The Imperative Intervention of leaders do reinforce an Absolute Organizational Succession". Several student's/research scholars and academicians have presented their research work at ICRAIC 2K25 in the areas of Robotics, Automation in Production, Intelligent Computing and Artificial Intelligence. We believe that the

knowledge exchanged at ICRAIC 2K25 immensely helps to the researchers working on relevant fields and contributes to the growth of science and technology.

Taking into account the various circumstances of the participant after COVID 19, ICRAIC was adopted all available social media methods, such as online/video presentation, etc, besides the regular presentation styles (oral & poster). The online/video presentation session was arranged via ZOOM platform. Authors were participated by online presentation and connected at the time of their session on online platform. Our sincere thanks to the keynote speakers, reviewers, technical and advisory committee members, organizing committee, and all authors for their contribution and making ICRAIC 2K25 a grand success.

About the Editors

Dr. Manoj A. Kumbhalkar Dr. Manoj A. Kumbhalkar is an accomplished academic in Mechanical Engineering, with a Bachelor's, Master's in CAD/CAM, and a Ph.D. from Rashtrasant Tukdoji Maharaj Nagpur University. He is currently an Associate Professor and Head of the Mechanical Engineering Department at JSPM Narhe Technical Campus, Pune. He has 16 years of teaching experience and has authored 27 conference papers, 48 journal articles, 5 books, and holds 2 patents. Dr. Kumbhalkar is also the Editor-in-Chief of the International Journal of Analytical, Experimental and Finite Element Analysis and has been involved in numerous prestigious journals and conferences as an editorial board member, reviewer and guest editor. His research interests include machine design, failure analysis, FEA, and biomechanics.

Dr. Radheshyam H. Gajghat is an Associate Professor in Automation and Robotics Engineering at Sandip Institute of Technology and Research Centre, Nashik. With over 30 years of experience in teaching, industry, research, and academic administration, he holds a BE in Production Engineering, an MTech from MNNIT Allahabad, and a PhD from RTM Nagpur University. His research focuses on Manufacturing Processes, Computer Integrated Manufacturing, Composite Materials, Engineering Education, and Human Factor Engineering. As Editor-in-Chief of the Journal of Production and Industrial Engineering, he has reviewed for prestigious journals and conferences. He has authored multiple research papers and developed ESPT, an innovative online tool that helps engineering students predict exam performance and enhance technical knowledge for better employability.

Dr. Jagdish D. Kene is an Assistant Professor in the Electronics and Communication Engineering Department at Ramdeobaba University, Nagpur. With 22 years of experience, he holds a Bachelor's and Master's in Electronics Engineering from Nagpur University and a PhD in Electronics Engineering from VNIT, Nagpur. His research focuses on wireless communication networks and signal processing, with 38 journal papers, 10 conference papers, 5 copyrights, and 1 patent to his name. He is a member of professional societies like ISTE, IRED, and IAENG. Dr. Kene also serves as a reviewer for several international journals and has delivered numerous guest lectures in his field.

About Research Association of Masters in Engineering

Research Association of Masters in Engineering is committed to providing a peer reviewed platform to outstanding researchers to exhibit their findings for the furtherance of technology to provide a research forum. We are devoted to continual innovation to better support the wishes of our communities, making sure the integrity of the research we publish, and championing the importance of open research.

We invite young students, scientist, researchers, and academician to contribute your research and promote to convert their research work in technical papers. The publication would also help in enhancing awareness about the need to become innovative and research minded. All articles presented in the conference will published in renowned journals and available to scientific researchers and innovators all over the globe. We provide a forum to publish the complementary aspects in science and engineering using computational methods and experimental measurements, and to stress the importance of their harmonious development and integration. Our aim is to become an effective medium for inspiring the innovators and researchers to bring out their contributions in the form of research papers, articles, case studies, review articles and innovations in the fields of engineering, science and technology.

Mission

To providing a peer reviewed platform to outstanding researchers to exhibit their findings for the furtherance of technology.

About the Conference ICRAIC 2K25

ICRAIC 2k25: International Conference on Robotics, Automation and Intelligent Computing focused on the development and integration of robot, digitalization, automation, and AI technologies, inviting well-known experts and scholars at home and abroad, as well as scientific researchers and industry practitioners in the field of intelligent control, to jointly discuss the cutting-edge technologies of robots and their new applications in different industries, and build a robot innovation ecosystem.

Taking into account the various circumstances faced by participants after COVID-19, ICRAIC adopted multiple presentation methods, including online and video presentations, alongside traditional oral and poster sessions. A dedicated online presentation session was arranged, allowing authors to participate remotely via the "ZOOM" platform. During the technical sessions of this e-Conference, participants successfully presented their research through the virtual medium, ensuring seamless knowledge exchange and broader accessibility.

Conference Website - https://conference.rame.org.in/icraic25/

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Message of Chief Guest

It gives me great pleasure to extend my greetings and warmest wishes to the Research Association of Masters in Engineering for organizing an 3rd International Conference on Robotics, Automation and Intelligent Computing (ICRAIC 2K25) during February 15, 2K25.

The conference on Robotics, Automation, and Intelligent Computing covers key areas transforming industries today. Robotics focuses on the design and control of robots, including autonomous systems and human-robot interaction. Automation explores the use of control systems in industrial processes, enhancing efficiency through smart manufacturing and process control. Intelligent Computing involves the application of AI, machine learning, and data analytics to simulate human intelligence in machines, improving decision-making and adaptability in robotics and automation. Together, these fields drive innovation across sectors like manufacturing, healthcare, and logistics, shaping the future of technology.

I am quite sure that this conference will ignite the creative ideas and exchange of knowledge to fill up the gaps in ongoing research on multifunctional automation.

I once again commend the core organizing team and wish the conference a resounding success.

Prof. Dr. Rakesh Himte
Principal,
Vidyavardhini's College of Engineering & Technology,
Vasai, Maharashtra, India.

Message of Distinguished Speaker

I feel truly delighted to learn that the Research Association of Masters in Engineering e- platform for the scientific community to share their ideas and research by organizing an 3rd International Conference on Robotics, Automation and Intelligent Computing (ICRAIC 2K25) during February 15, 2K25.

The subject is indeed fascinating as it delves into the latest advancements in Robotics, Automation, and Intelligent Computing, which are rapidly reshaping industries. These technologies, powered by artificial intelligence, are enabling machines to perform tasks with higher precision, autonomy, and efficiency. From smart factories to autonomous vehicles, AI-driven innovations are not only enhancing productivity but also creating entirely new possibilities in everyday life. This silent revolution is paving the way for a future where humans and machines collaborate seamlessly, opening doors to unprecedented opportunities across various fields.

It is also vital to grasp the underlying fundamental concepts of science, apart from developing applicable technology. ICRAIC 2K25, therefore, takes on particular relevance. I think the attendees will profit immensely.

My congratulations to the organizing team, and I extend my best wishes for its successful completion.

Dr. Rudrarup Gupta
Faculty, Tagore School of Rural Development and
Agriculture Management, University of Kalyani,
Guest Lecturer, Faculty of Agriculture, JIS University,
Founder, Skill Development Interface, Kolkata, India

Message of Conference Chair

I am very happy to share that Research Association of Masters in Engineering is organizing an 3rd International Conference on Robotics, Automation and Intelligent Computing (ICRAIC 2K25) during February 15, 2K25.

The fast advancements in technology make the promotion of technical competence in the workforce highly essential nowadays. One of the main problems for scientists is the implementation of their highly specialized research in many domains of human knowledge and interdisciplinary study. This problem must be seen as an opportunity for human resources development in a variety of areas. The other significant problem is to discover how these material advancements may be utilized to better the everyday job and the common person's surroundings. In these recent years there has been a lot of focus to promoting cross-disciplinary research with specific issues in robotics, automation and intelligent computing.

I'm confident there will be many intellectually engaging contacts and the presentation of constructive ideas which would benefit a broad spectrum of participants in the conference on current achievements in robotics, automation and intelligent computing.

I congratulate the team of RAME and extend my best wishes for its success.

Dr. M. A. Kumbhalkar
President,
Research Association of Masters in Engineering,
India.

Message of Convener

I am pleased to know that the Research Association of Masters in Engineering is organizing an 3rd International Conference on Robotics, Automation and Intelligent Computing (ICRAIC 2K25) during February 15, 2K25.

The present requirement of our society is to develop the abilities to address different challenges of individuals with a scientific temperament. Research in robotics, automation and intelligent computing covers several fields, which get different information from multidisciplinary sources. AI research is getting more and more inclusive. I'm delighted that the invited speakers for the event are well-known speakers from around the world.

I am convinced that at this magnificent conference on knowledge the mainstay of robotics, automation and intelligent computing will put together the insight and wisdom appropriate to human growth.

I congratulate the Research Association of Masters in Engineering for organizing such event and convey my best wishes for all success.

Dr. R. H. Gajghat
Member,
Research Association of Masters in Engineering,
India

Message of Convener

It gives me immense pleasure to know that Research Association of Masters in Engineering is organizing an 3rd International Conference on Robotics, Automation and Intelligent Computing (ICRAIC 2K25) during February 15, 2K25.

The subject of the conference is intriguing since it includes a wide variety of robotics, automation and intelligent computing characteristics. The emergence of huge potential uses of artificial intelligence constantly leads to major societal transformations. The wall of traditional subjects' collapses in the modern world and we see the spread of one domain's ideas into the next. The coagulation of thoughts can lead us all to the crossroads when the unity of knowledge from many fields can be noticed.

I am confident that debates and conversations at this e-conference will encourage the younger brains to understand the science and technology of robotics, automation and intelligent computing.

My congratulations to the whole organizing team and best wishes for the grand success of the event.

Dr. Jagdish D. Kene
Member,
Research Association of Masters in Engineering,
India

ICRAIC-2K25 Program Schedule

15th February 2025	
Time	**Activity**
9:45 AM – 10:00 AM	Online Platform Open
10:00 AM – 10:30 AM	Inaugural Ceremony of ICRAIC 2K25 *Chief Guest: Prof. Dr. Rakesh Himte* Principal, Vidyavardhini's College of Engineering & Technology, Vasai
10:30 AM – 11:00 AM	Keynote Session *Distinguished Speaker: Dr. Rudrarup Gupta* Skill Development Interface, Kolkata, India
11:00 AM – 11:15AM	Short Break
11:15 AM – 1:15 PM	*Technical Session 1* Track 1: Intelligent Computing and Artificial Intelligence
1:15 PM – 1:45 PM	Long Break
1:45 PM – 3:45 PM	*Technical Session 2* Track 2: Robotics and Automation in Production
3:45 PM – 4:00 PM	Short Break
4:00 PM – 4:30 PM	*Conference Valedictory*

Distinguished Speaker
Abstract

THE IMPERATIVE INTERVENTION OF LEADERS DO REINFORCE AN ABSOLUTE ORGANIZATIONAL SUCCESSION

ICRAIC_2K25_001

Rudrarup Gupta

Proprietor, Skill Development Interface, Kolkata, India
Faculty, Tagore School of Rural Development and Agriculture Management
Guest Lecturer, School of Agricultural Sciences, JIS University

Abstract: Empowerment of "Thoughtful Leaders" is a most significant incorporation of an organization from the perspective of its lively infrastructural base. Most notably, this term "Organization" is based upon a number of functional brains and the matured cognitive reflections at the same point of time. That is why; leaders to try to arrange for a substantial amount of money as strengthen "Business capital" and on the other hand, they are equally concerned about to empower the most methodical resources to ensure their constructive commercial beginning which is undoubtedly very healthy not only to establish their productive benevolence in the end. Leaders are well versed to carry their collective frame of mind with everlasting determination not only for "Successful Resource Empowerment" to initiate their constructive business planning and its powerful capitalization in all the regards. The prime motive is to survive in embarking the exiting occupational virtuoso which would definitely be unbeaten and unforgettable in nature respectively. This is how; all the diligent associates will be deliberately empowered along with their never-ending devotion to explore their collective occupational resilience to opt for business as much as possible which is related with their much anticipated sustainability indeed. In other words, any communal harmony of an organization is highly successful once their loop of communication is absolutely up to the mark. Therefore, promising integrity, cultural diversity an invariable organizational unity are candidly essential for both leaders and followers to snatch the favorable outcome in the end.

Keywords: Proactive occupational resilience, b. significant initiatives of leaders, c. Distinctive cooperation of leaders, d. meticulous organizational elevation, e. Proper implementation of cognitive thoughts, f. successful functionality of an organization

TRACK 1

Intelligent Computing and Artificial Intelligence

ADVANCEMENT IN WASTE MANAGEMENT: A SURVEY ON DETECTION, CLASSIFICATION AND ROBOTIC SYSTEMS

ICRAIC_2K25_006

Divya Mohan

Albertian Institute of Science and Technology, Kochi, Kerala, India

Abstract: The challenges posed by urbanization and industrialization demand innovative solutions for efficient resource management. This survey explores advancements in automated systems leveraging artificial intelligence (AI), machine learning, and robotics to improve waste management processes. State-of-the-art methods like YOLO (You Only Look Once) and MobileNetV3, combined with advanced datasets and data augmentation, have enhanced real-time detection and classification accuracy. Robotic integration with precision-driven methods has revolutionized sorting and segregation tasks, enabling real-time and scalable solutions. Key developments include high-performance models such as YOLOv5, YOLOv6, and YOLOv8 for waste detection and optimized MobileNetV3 for efficient sorting, especially in resource-constrained environments. This paper highlights the transformative impact of these technologies, which streamline operations, reduce environmental pollution, and support recycling efforts while addressing urban waste management challenges.

Keywords: Urbanization, AI, Robotics, Waste Management, YOLO

ADVANCING LEUKEMIA DETECTION: AUTOMATED BONE MARROW CELL CLASSIFICATION USING TRANSFER LEARNING

ICRAIC_2K25_008

Daksh Bangoria, Abhi Bhimani[*], Sarita Thummar

Department of Computer Engineering, CHARUSAT University, Changa, Gujarat, India

Abstract: Bone marrow cell classification plays a crucial role in diagnosing various hematological disorders. This study applies deep learning to improve the accuracy and efficiency of bone marrow cell classification. An important task in the diagnosis of hematological disease is the automated classification of bone marrow cells, which we examine through the use of deep learning models. We used transfer learning to evaluate eight convolutional neural network architectures (DenseNet-121, VGG-16, ResNet-50, ResNet-152, MobileNet-V2, Inception-V3, Xception, and EfficientNetB5) on a huge dataset of over 170,000 expertly annotated bone marrow cell images from 21 classes. The dataset was divided into training, testing, and validation sets. High-performance GPU hardware was used to train the models. Performance was measured using standard metrics like as accuracy, precision, recall, and F1-score. The Xception model outperformed the others, with 83% validation accuracy. Notably, rare cell types such as Faggot cells, hairy cells and smudge cells faced classification challenges, emphasizing the need for further training data in these areas. Our results highlight the potential of deep learning to increase bone marrow cell classification's effectiveness and accuracy while also highlighting areas that need to be improved going forward, especially when it comes to handling rare cell types and class imbalance. This research contributes to the continuous development of automated hematological diagnostic tools, which have the potential to improve the speed and reliability of leukemia identification and categorization.

Keywords: Leukemia Detection, Deep Learning, Transfer Learning, Bone Marrow Cell Classification

PREDICTING STUDENT PERFORMANCE BASED ON RNN AND LSTM ALGORITHMS

Randa shaker Abd-Alhussain[1], Hadeel Talib Mangi[2], Radhwan Samandari[3]

[1]Presidency of the University of Babylon, Department of Missions and Cultural Relations, University of Babylon, Babylon, Iraq.

[2] University of Hilla, Science Collage, Computer Science Department, Babylon, Iraq.

[3]Ministry of Finance, Babylon, Iraq.

Abstract: Predicting student academic performance is of paramount importance to educational institutions due to its enormous ripple effects on the progress and development of any society at large. In order to enhance the precision of these predictions, the application of deep learning models, specifically Recurrent Neural Networks (RNNs), and Long Short-Term Memory (LSTM) networks are investigated in this work. Even with such a dynamic nature of learning and so many variables affecting the outcomes, predicting students' success is such an arduous task. This research has tried to model the problem with RNNs and LSTMs so that temporal dependencies and patterns in students' learning data could be captured. Data was encrypted using Advanced Encryption Standard (AES) technique before being stored in a database to maintain and ensure its integrity. In this study, an important consideration is to identify where students' deficiencies lie while factoring in individual differences, as this helps in designing targeted interventions to improve academic performance. The outcomes showed that the LSTM and RNN models, respectively, had accuracy rates of 75% and 96%, indicating the promise of these deep learning techniques in tasks involving educational prediction.

Keywords: Student Performance Prediction, RNN, LSTM, student academic performance, AES.

ENHANCED FEATURE DISCRIMINATIVE DEEP LEARNING FOR PERSON RE-IDENTIFICATION WITH HORIZONTAL PYRAMIDAL NETWORK

ICRAIC_2K25_011

Abhinav Parkhi, Atish Khobragade

Department of Electronics & Telecommunication Engineering, YCCE, Nagpur, India

Abstract: Re-identification (ReID) of people necessitates the acquisition of multi-scale, view-invariant, exclusive visualizations of an object's visibility with varying conceptual levels. To obtain a single comprehensive representation, the scientific community has recently concentrated on acquiring profound Re-ID models. More visual characteristics and models that are driven by objects have been investigated in an attempt to improve the results obtained, which unavoidably involves more computational or human labor for labeling. In an effort to minimize this kind of failure, we suggest using a simple but powerful Horizontal Pyramid Matching technique to fully utilize the many incomplete portions of a particular person's appearance, allowing for the identification of the right candidates even in the absence of some crucial details. First, the deep feature maps are divided into varying numbers of partial feature bins in order to extract horizontal pyramid features. The architecture is more resilient in complicated environments because these feature bins with varied scales can contain local information in addition to global information in various spatial scales. We then utilize person-specific discriminatory data in a global-local way by utilizing adaptable pooling algorithms. The suggested framework conducts domain transformation successfully and exceeds the most advanced unsupervised cross-domain individual re-identification techniques, as demonstrated by the results on Market1501 and DukeMTMC-reID.

Keywords: Person re-identification, deep learning, pooling network

IOT – INTEGRATED DEEP LEARNING APPROACH FOR FOOD FRESHNESS MONITORING

ICRAIC_2K25_12

Dr. C. Pabitha, Santhiya G,Sharulatha R, Shobika B S

Department of CSE, SRM Valliammai Engineering College, Kattankulathur, Tamil Nadu, India

Abstract: These days, we need to be more mindful of the quality of the food we eat and provide for our loved ones. Eating fresh food is the best way to acquire all the nutrients and minerals it contains and prevent needless health issues. We may use a variety of techniques to assess the freshness and quality of our food products, such as the conventional lab testing method, visual analysis of the food sample using different machine learning and deep learning algorithms, and even the scent of the food sample. Numerous machine learning models have been created to determine whether food samples are fresh, however they are not always quick or precise. We have developed an Internet of Things model that uses deep learning algorithms to more rapidly and reliably determine the freshness of food samples by analysing their image and aroma. We have combined two deep learning picture detection algorithms to improve the results. The food sample photographs are classified using a Convolutional Neural Network, and the affected areas are identified using the Object Detection Algorithm YOLO. Furthermore, we employ an artificial neural network model to assess the level of spoiling and sensors to detect the amount of gas produced by spoiled food samples. We can determine which areas are rotting or harmed by integrating the numbers from the picture data with the gas emitted by the given food sample. The outcome can be seen in a browser application.

Keywords: CNN, ANN, IOT, YOLO, deep learning algorithms.

IMAGE ENHANCEMENT USING MACHINE LEARNING AND DEEP LEARNING

ICRAIC_2K25_013

Kathan Shah[1], Parth Shah[1], Devarshi Patel[2], Rikita Chokshi[1]

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[2]Department of Information Technology, New L J Institute of Engineering and Technology, Ahmedabad, India

Abstract: This paper presents an advanced approach to image restoration, leveraging machine learning techniques to address challenges in deblurring and denoising. Traditional image restoration methods often struggle with complex degradation patterns, such as motion blur and noise, that obscure image clarity. Our research combines deep learning-based techniques with reinforcement learning (RL) to create a model capable of adaptive, end-to-end restoration in real-world conditions. By utilizing a convolutional neural network (CNN) for pattern recognition and a generative adversarial network (GAN) for producing visually realistic images, our approach significantly enhances restoration accuracy. The integration of RL as a sequential decision-making framework further improves image quality by iteratively adjusting pixels based on their impact on overall clarity. This paper demonstrates the model's effectiveness in restoring high-quality images from degraded inputs, making it suitable for applications in medical imaging, surveillance, and remote sensing.

Keywords: Deep Learning, DeblurGAN, Neural network, CNN, Reinforcement learning, Image Restoration.

A KNN BI-CLUSTERING APPROACH FOR ENHANCED TAG-BASED RECOMMENDATION SYSTEMS

Mahesh Mali

Computer Engineering Department, Mukesh Patel School of Technology Management and Engineering, NMIMS University, Mumbai, India

A bstract: With the onset of the new age, consumers are overwhelmed by the many choices of movies that can be watched. A solution gives rise to the need for a recommendation system (RecSys) that will suggest a title to the user based on user requirements. The new RecSys must be able to address the issues that exist within the plethora of general RecSys. In this work, we have implemented a novel Tag-based RecSys to improve the quality and usefulness of recommendations with the help of user information, based on movie tags. This paper proposes a bi-clustering approach for clustering movies and users simultaneously. This work is implemented using MovieLens datasets. In trying to gauge the efficacy of the new RecSys, the final RMSE of our Tag-based RecSys is 0.9984 and MAE is 0.8450. The system also produces more personalized results for users checked by personalizing scores. The system evaluation shows considerably positive results.

Keywords: Tag-based Recommendation system, Movies Tag Analysis, Tag-based movie recommendation system

NAVIGATING THE FUTURE OF HEALTHCARE: THE INTEGRATION OF ARTIFICIAL INTELLIGENCE AND THE NEED FOR SECOND OPINIONS

ICRAIC_2K25_019

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Abstract: The incorporation of Artificial Intelligence (AI) along with the healthcare sector has turned up as a transformative force, significantly enhancing diagnostic capabilities and improving patient care. This study investigates the effects and possibilities of second opinion in disease diagnosis with a particular concentrate on the difficulties and possibilities presented by AI and Machine Learning(ML) technologies. It highlights the exponential growth of AI applications in clinical settings, notably in digital pathology and hematology, where AI tools have shown promise in automating diagnoses and supporting healthcare professionals. Furthermore, the importance of second opinions in medical decision-making is underscored, emphasizing how AI can facilitate this process by providing independent assessments of diagnoses and treatment options. Notwithstanding the possible advantages, obstacles such as data standardization, algorithm transparency, and ethical considerations persist, necessitating further research and validation of AI systems in clinical practice. As healthcare systems evolve, embracing AI-driven approaches to diagnostics and promoting the routine use of second opinions could lead to improved patient outcomes and enhanced trust in medical decision-making.

Keywords: Artificial Intelligence, Machine Learning, Second Opinion, Medical Diagnosis, Predictive Analysis

REVIEW ON VARIOUS RECOGNITION SYSTEMS IN HUMAN ROBOT INTERACTION

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Abstract: In this review article, the progress of robotic arm voice control technology will be provided and also how companies from different sectors have immensely benefited due to such a human-robot interaction. Voice controlled robotic arms in different sectors such as manufacturing, healthcare and assistive technologies that require limbs. The paper explains the basic technologies such as Artificial intelligence (AI), machine learning (ML), NLP which enables voice recognition systems to learn human speech patterns. Therein lies the need for supporting multilanguage in voice recognition to assist numerous people simply. It further examines how multimodal solutions that combine speech interfaces with other input modalities like gesture recognition and tactile feedback can be used to maintain a suitable level of control accuracy and adaptability in realistic uses. This incorporates noise, latency, and the upcoming solutions for these complications including adaptive algorithms and deep learning practices.

Keywords: Natural Language Processing, Multimodal, Gesture recognition, Robot Operating System

OPTIMIZING ENERGY MANAGEMENT AND BILLING EFFICIENCY: THE ROLE OF ADVANCED METERING INFRASTRUCTURE IN ELECTRIC VEHICLE CHARGING SYSTEM

ICRAIC_2K25_022

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Abstract: The urgent necessity to build an efficient, scalable, and reliable energy management system poses a persuasive call to modernize electric vehicle integration into the power grid. Advanced Metering Infrastructure is established by optimizing charging processes and achieving accurate billing, among other things, to offer real-time data on energy consumption of electric vehicles. The paper has discussed the employment of the AMI within the electric vehicle charging systems for the purpose of its functionality toward the better grid management, cost-effective energy, and price elasticity in dynamic pricing. This research also discussed about the interoperability between the AMI system with the existing smart grid systems, data transmission security, and various demand response programs which will be used to maintain an equilibrium of the loads on the grid. Key challenges and solutions for the integration of AMI with EV infrastructure are discussed, along with future trends and research opportunities in this domain.

Keywords: Advanced Metering Infrastructure (AMI), Electric Vehicles (EVs), Energy Management, Smart Grid, Charging Systems, Billing Efficiency, Real-Time Data, Demand Response, Grid Management, Dynamic Pricing

PORTABLE SOLAR PANEL CLEANING BOT USING ARDUINO MEGA 2560

ICRAIC_2K25_023

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Abstract: Solar energy is a renewable energy source , but dust, dirt, and debris can be accumulated on the solar panels that can reduces the efficiency . Manual cleaning is labor-intensive, expensive, and inefficient for large-scale solar farms. Thus, we propose a Portable Solar Panel Cleaning Bot based on the Arduino Mega 2560. The autonomous robot employs IR sensors which detect panel edges to prevent if from falling, a rotating brush system for cleaning, and a TB6612FNG motor driver for precise movement. The bot effectively removes dust, reduces manual labor, and minimizes maintenance costs while maintaining optimal energy output. The bot is compact and lightweight which ensure easy deployment and makes it portable .With its self-sustaining power source having lithium-ion battery and onboard solar panel, the system improves solar energy efficiency in a sustainable and eco-friendly way. It can have future improvements include AI-driven navigation, waterless cleaning mechanisms, and IoT integration for remote monitoring.

Keywords: Solar energy, Autonomous robot, Arduino Mega 2560, Solar panel cleaning, Eco-friendly solution

VOICE GUIDED ASSISTANCE DEVICE

ICRAIC_2K25_024

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Abstract: The presentation introduces a Voice Guided Assistance Device developed to significantly enhance the accessibility of printed and handwritten text for visually impaired individuals. By leveraging real-time Optical Character Recognition (OCR) technology, the device captures text via an embedded camera and converts it into audible speech, allowing users to interact independently with their environment. Designed with portability and ease of use in mind, the device is lightweight and wearable, making it practical for daily activities without necessitating bulky equipment. Our project emphasizes the integration of cost-effective, open-source software and hardware, ensuring that the solution is affordable and accessible to a broad audience. The presentation will outline the methodology used in designing the device, discuss the implications for independence among visually impaired individuals, and address future directions for enhancing assistive technologies in this field. Through this innovative approach, we aim to empower users and improve their quality of life by facilitating greater autonomy in everyday tasks.

Keywords: Voice guided assistance, Optical Character Recognition (OCR), Visually impaired, Wearable device, Assistive technology

SMART IOT BASED MONITORING SYSTEM FOR ENHANCED BATTLEFIELD SITUATIONAL AWARENESS

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Abstract: In modern warfare, real-time situational awareness is essential for effective decision-making. This research presents an IoT-based monitoring system designed to enhance battlefield intelligence, soldier safety, and operational efficiency. The system integrates various IoT sensors, and real-time communication to provide military personnel with critical insights into environmental conditions, soldier health, and battlefield navigation.

Key components of the system include:

- Wearable biomedical sensors that track vitals like heart rate and body temperature, ensuring continuous health monitoring.
- Environmental sensors (e.g., air quality, temperature, humidity) that detect hazardous conditions and send instant alerts.
- GPS and LiDAR-based mapping, which enables precise positioning and navigation, even in GPS-denied environments like forests or urban warfare zones.

This research highlights the potential of IoT-based monitoring systems in transforming military operations, improving response times, and reducing casualties on the battlefield.

Keywords: IoT-based monitoring, Soldier health, Environmental sensors, GPS and LiDAR, Battlefield intelligence

TRACK 2

Robotics and Automation in Production

SMART WAREHOUSE AUTOMATION: A SCALABLE APPROACH TO AUTOMATED STORAGE AND RETRIEVAL SYSTEMS

ICRAIC_2K25_026

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Abstract: As industries grow and technology advances, warehouses need smarter solutions to store and retrieve goods efficiently. This project focuses on designing and building a scalable Automatic Storage and Retrieval System (AS/RS) that uses automation to make warehouse operations faster, more accurate, and cost-effective. By combining robotics, IoT technology, and AI-based analysis, this system helps manage inventory smoothly and reduces errors.

The AS/RS is designed to be flexible, making it suitable for warehouses of different sizes. It includes robotic arms, conveyor belts, and automated guided vehicles (AGVs) that work together to move items with minimal human effort. A real-time tracking system keeps inventory records accurate, ensuring quick and precise retrieval of products.

The project also includes a strong mechanical framework equipped with smart sensors and control systems for smooth operation. Cloud-based monitoring allows for predictive maintenance, which helps prevent breakdowns and keeps the system running efficiently. AI algorithms are used to make the best use of storage space, speeding up order processing and increasing storage capacity.

This research demonstrates how an adaptable AS/RS can revolutionize warehouse management by minimizing manual labour, enhancing workplace safety, and improving overall efficiency. The developed model validates the feasibility of implementing such a system across various industries, making supply chains more intelligent and dependable. Furthermore, the system supports scalability, allowing businesses to expand without compromising efficiency. The implementation of such automation enhances sustainability by reducing energy consumption and material wastage. By integrating these

technologies, businesses can achieve higher profitability and competitive advantages in a rapidly evolving industrial landscape.

Keywords: Automated Storage and Retrieval System, Warehouse Automation, Robotics, IoT, AI, Predictive Maintenance, Smart Warehousing

DEVELOPMENT OF SCALABLE AUTOMATED TRUCK LOADING UNLOADING SYSTEM FOR LOGISTICS INDUSTRIES

ICRAIC_2K25_27

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Abstract: In the logistics industry, loading and unloading trucks is a time-consuming and labor-intensive process. Manual handling of goods often leads to delays, inefficiencies, and safety risks. To overcome these challenges, this project focuses on developing a Scalable Automated Truck Loading and Unloading System that can improve the speed, accuracy, and safety of material handling operations. The proposed system consists of conveyor belts, robotic arms, sensors, and programmable logic controllers (PLCs) to automate the movement of goods. It is designed to handle different types of cargo, including boxes, pallets, and containers, without the need for manual labor. The system can be customized to work with various truck sizes and warehouse layouts, making it a scalable and flexible solution for logistics companies. One of the key features of this system is computer vision and artificial intelligence (AI), which help in detecting the position and orientation of goods. AI algorithms optimize the loading and unloading sequence to prevent damage and ensure efficient space utilization. IoT-based real-time monitoring is also integrated, allowing warehouse managers to track the system's performance, detect issues, and schedule maintenance to reduce downtime.

Another major advantage of this system is its ability to reduce operational costs by minimizing the need for human labor. By automating the process, companies can achieve faster turnaround times, reducing the waiting period for trucks and improving overall supply chain efficiency. The system is also designed to work in harsh environments where manual labor may not be suitable, such as cold storage warehouses or hazardous material handling. Safety is a crucial factor in logistics operations, and this automated system significantly enhances workplace safety. It eliminates the risk of injuries caused by lifting heavy loads, exposure to harmful environments, and accidents due to human error. Additionally, the system can be equipped with safety sensors and emergency stop mechanisms to prevent any malfunctions

or damage to goods and equipment.A key aspect of this project is its integration with existing Warehouse Management Systems (WMS). The system can communicate with WMS software to synchronize loading and unloading schedules, track inventory movement, and generate real-time reports for better decision-making. This ensures seamless coordination between warehouse operations and transportation logistics.

The scalability of this system makes it ideal for both small warehouses and large-scale distribution centers. Logistics companies can start with a basic setup and gradually expand the automation level based on their needs. The system is also designed to be energy-efficient, reducing overall power consumption and contributing to sustainable logistics practices. the Scalable Automated Truck Loading and Unloading System offers a cost-effective, efficient, and safe solution for the logistics industry. By leveraging advanced technologies like AI, IoT, and robotics, this system can streamline material handling, improve productivity, and enhance operational safety. With increasing demands in the logistics sector, such automation solutions will play a crucial role in meeting future industry requirements and optimizing supply chain operations.

Keywords: Automated Truck, Loading System, Unloading System, Logistics Industries

FABRICATION OF SMALL SCALE AGRICULTURAL ROBOT FOR HIGH PRODUCTIVITY OF CORPS

ICRAIC_2K25_28

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Abstract: The rapid advancements in technology have created opportunities for automation in various fields, including agriculture. This project aims to develop an small scale automated robotic system based on Arduino Uno to assist in agricultural tasks such as plowing, seeding, and irrigation for high productivity of corps. The robot is designed to reduce manual labor, increase efficiency, and ensure precision in field operations. The system comprises an Arduino microcontroller as the central processing unit, interfaced with various sensors and actuator stoper form essential agricultural tasks. The robot's movement and actions are controlled viaa Bluetooth-enabled smartphone, providing wireless control over long distances. The use of Bluetooth technology ensures that the system is cost-effective, easy to implement, and user friendly for farmers who may not have access to complex network infrastructure. The robot's design includes motor drivers for locomotion, seed dispensers for sowing, and a mechanism for watering crops. Sensors are employed to monitor soil moisture, temperature, and humidity, allowing the robot to adjust its actions based on environmental conditions. This not only improves the precision of farming activities but also optimizes water usage and enhances crop yield. The project demonstrates the potential of integrating automation and wireless technology in agriculture, showcasing how small-scale, affordable robots can assist in modernizing farming practices. Future developments could include autonomous navigation, GPS integration, and machine learning algorithms to further enhance the robot's capabilities. An Arduino Based Agriculture Robot Using Bluetooth is additionally presented in this project.

Keywords: Agriculture robot, Fabrication, Sustainable development, Robotics, Automated robotic system, High productivity of corps

LIDAR AND ROS POWERED INDOOR HOME MAPPING AND POSITIONING ROBOT

ICRAIC_2K25_29

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Abstract: Simultaneous Localization and Mapping (SLAM) is a fundamental technology in autonomous robotics, allowing robots to create a map of an unknown environment while simultaneously tracking their position within it. For home robots, efficient SLAM implementation is crucial to ensure precise navigation and interaction within dynamic and cluttered indoor spaces. However, conventional SLAM techniques often struggle with real-time adaptation, localization errors, and computational efficiency, particularly in unstructured home environments where furniture rearrangements and human movement create additional challenges. This paper explores the optimization of SLAM for home robots using Light Detection and Ranging (LiDAR) sensors integrated with the Robot Operating System (ROS). We analyze various SLAM algorithms, including GMapping, Hector SLAM, and Cartographer, comparing their performance in terms of localization accuracy, computational speed, and adaptability to real-world home environments. The research focuses on enhancing sensor fusion techniques, optimizing data processing pipelines, and reducing mapping errors to improve overall SLAM performance. By leveraging advanced filtering methods and dynamic obstacle detection, we propose a refined approach that enhances both the efficiency and robustness of SLAM in domestic settings. To validate our approach, we conduct extensive experiments in simulated and real-world home environments. The results indicate significant improvements in map consistency, reduced localization drift, and enhanced real-time processing efficiency compared to conventional SLAM implementations. These findings contribute to the development of more intelligent and adaptive home robots capable of seamless navigation and interaction within smart homes. The study's insights have practical applications in household automation, elderly assistance, and service robotics, paving the way for more autonomous and user-friendly robotic solutions in residential spaces. The

implementation of optimized SLAM algorithms will improve not only home robotics but also other applications such as security surveillance, warehouse automation, and assistive technology for individuals with disabilities. Future research will focus on integrating AI-based decision-making for even greater efficiency and adaptability in home robotic systems.

Keywords: LiDAR-based Navigation, ROS, Autonomous Mobile Robot (AMR), Indoor Mapping, ROS2, SLAM Optimization, Real-time Environment Mapping

FABRICATION OF AUTOMATIC MULTIPLE VEGETABLE TRANSPLANTER

ICRAIC_2K25_30

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Abstract: In modern agriculture, labor shortages and the demand for increased efficiency have driven advancements in mechanized planting systems. The automated vegetable transplanter addresses these challenges by enabling precise and efficient transplanting of seedlings across various types of fields. This system automates the traditionally labor-intensive process, using robotic mechanisms and sensor-driven technologies to handle seedlings delicately, ensuring minimal damage and optimal positioning in the soil.

Key features include a conveyor or carousel system for seedling delivery, robotic arms for handling and placement, and GPS or machine vision guidance for precise spacing and depth control. The transplanter is adaptable to a range of soil conditions, vegetable types, and planting configurations.

By reducing manual labor and improving planting speed and uniformity, the automated vegetable transplanter contributes to increased agricultural productivity and sustainability, making it a valuable innovation for large scale and precision farming. Further research aims to enhance the system's adaptability, reliability, and cost effectiveness to expand its accessibility and use in diverse agricultural settings.

Keywords: Modern agriculture, Labor shortages, Increased Efficiency, Mechanized planting systems, Automated vegetable transplanter, Precise transplanting, Agricultural innovation

DESIGN AND DEVELOPMENT OF IOT BASED FULLY AUTOMATED HYDROPONIC SYSTEM

ICRAIC_2K25_31

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Abstract: Hydroponics is a farming method in which the crops are grown without the use of soil. The plants are placed in a water solution enriched with macro and micronutrients essential for plant growth. Hydroponics is also called as Controlled Environment Agriculture (CEA). In traditional farming, soil erosion and infertility of soil plays a major role by decreasing the crop yields. The use of pesticides is also a major concern.

This paper proposes a fully automated Internet of Things (IoT) based hydroponic system which senses, monitors and controls important factors like pH, Total Dissolved Solids (TDS), environmental temperature, humidity and lighting inside the green house. Assortment of 7 sensors along with 6 actuators helped in developing the proposed system. With the usage of IoT a mobile application is developed for real time viewing of environmental and nutritional variables.

A user notification is given in the mobile application if there are anomalous conditions detected in the green house. User would be able to view the green house with the mobile application, with the help of camera that is interfaced for live viewing. MQTT protocol is responsible for exchanging the data within remote devices and controllers. The crop selected for experimenting the proposed hydroponic model is coriander, which was monitored for 18 days and good results were seen. This proposed system demonstrates successful hydroponic system that is completely automated which reduces the manual labor work and grows a completely chemical and pesticide free

This paper presents an automated hydroponic system designed to enhance plant growth efficiency with minimal human intervention. The system uses sensors to monitor key parameters such as water level, pH,

temperature, and nutrient concentration. A microcontroller processes the data and automatically adjusts water and nutrient delivery to maintain optimal conditions. This automation improves plant yield, reduces water waste, and ensures consistent crop production. The system is suitable for both small-scale and commercial hydroponics, offering a cost-effective and sustainable solution for modern agriculture.

Keywords: Hydroponic System, IoT, crops, Moisture sensor, Automation, Robotics, Predictive Maintenance, Crop production

DESIGN OF IOT FACE RECOGNITION AI ROBOT

ICRAIC_2K25_33

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Abstract: The increasing demand for intelligent security solutions has driven the development of advanced technologies combining Artificial Intelligence (AI), Internet of Things (IoT), and robotics. This project, titled "Designing an IoT Face Recognition AI Robot," aims to create a fully automated robot capable of performing real-time face recognition for smart access control and surveillance applications. The system integrates AI-based facial recognition algorithms with IoT-enabled communication, making the robot accessible and controllable remotely through mobile or web platforms. The face recognition algorithm leverages pre-trained deep learning models to accurately detect and identify individuals, ensuring high reliability under varying environmental conditions. The robot's hardware architecture is built using Raspberry Pi and Arduino microcontrollers, coupled with cameras and essential sensors to gather data. Servo motors and other actuators provide movement capabilities, enabling the robot to interact with the environment autonomously. The IoT framework ensures real-time data exchange, enabling seamless notifications, remote monitoring, and control. The project also explores multiple use cases, such as restricted access areas, attendance monitoring, and home security, demonstrating the versatility of the system. A key focus of the project is achieving optimal performance with limited computational resources and addressing privacy concerns through secure data handling. The outcome of this project offers an innovative solution that combines robotics, AI, and IoT, contributing to the future of smart security systems.

Keywords: IoT, Face Recognition, AI, Robot, Security, Raspberry Pi, Arduino, Deep Learning, Surveillance, Smart Access Control

DESIGN AND DEVELOPMENT OF HOSPITAL SANITIZING ROBOT

ICRAIC_2K25_34

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Abstract: For Sanitizing hospital rooms with human effort is not an easy task. It increases the chances of contracting infections, leading to further spread of harmful microorganisms. The UV sanitization robot uses the power of UV rays to kill germs and bacteria. The robot can also give a live video stream of its surroundings. With the help of WIFI, we can control the robot and its GUI allows us to drive the robot inside a hospital room without physically being there. All this enables us to sanitize the hospital room as per our requirements. By killing the germs, the UV light restricts their multiplication by destroying their reproductive system. Service robots are increasingly present in all fields of medicine. The aim of the present work is to contribute in the fight against the spread of infectious diseases in hospitals, public transport, airlines and any enclosed areas. In this study, we have adopted the physical disinfection method by using UV. Use of these service robots reduces the risk of infection, cost of traditional cleaning and disinfection and most importantly acquires confidence and security in medical facilities.

Keywords: UV, Robot, Sanitizer, Disinfect.

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