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ADAPTIVE REINFORCEMENT LEARNING STRATEGIES FOR EFFICIENT PARKING SPACE MANAGEMENT IN FULLY AUTOMATED MULTI-LEVEL PARKING SYSTEMS

Student, Master of Technology in Industrial Automation Degree Dzapasi T. D.[1]
Lecturer Duri R.[1], PhD Tyavlovsky A. K.[2]
[1]Harare Institute of Technology, Harare, Zimbabwe
[2]Belarusian National Technical University, Minsk, Belarus

The rapid urbanization and increasing vehicle ownership have intensified the need for efficient parking solutions, particularly in densely populated urban centers. Fully automated multi-level parking systems offer a promising avenue to address these challenges, yet the dynamic allocation of parking spaces remains a critical bottleneck in optimizing system efficiency and user experience. This paper introduces an innovative adaptive Reinforcement Learning (RL) framework specifically designed for fully automated multi-level parking systems, leveraging a Deep Q-Learning algorithm to address the complexities of real-time space allocation. The approach focuses on the development of a state space that integrates high-resolution real-time data, including vehicle dimensions, parking duration, temporal demand patterns, and system occupancy levels. This granular representation enables the RL model to capture the nuanced dynamics of parking behavior, ensuring precise and context-aware decision-making. The action space is engineered to facilitate adaptive strategies such as priority-based slot assignment, dynamic rerouting of vehicles, and load balancing across parking levels, ensuring optimal resource utilization under varying demand conditions.

A novel reward function is proposed to balance competing objectives: maximizing space utilization, minimizing vehicle search times, and reducing energy consumption associated with automated system operations. By prioritizing user-centric metrics, such as average wait time and system throughput, our model ensures a seamless and efficient parking experience. Through extensive simulations in lucrative and realistic multi-level 3D parking environment, we demonstrate that our RL-based framework achieves a 10 % reduction in vehicle search times and a 15 % improvement in system throughput compared to conventional heuristic methods. These results highlight the transformative potential of adaptive RL in redefining parking management for fully automated systems. This research not only advances the theoretical foundations of RL applications in smart transportation but also provides practical insights for the deployment of next-generation automated parking infrastructures. The implications of our findings are profound; by integrating intelligent algorithms into urban infrastructure, we can redefine parking management in response to the dynamic needs of modern mobility. As cities evolve, the question remains: how will we leverage such technologies to create smarter, more efficient urban environments? The journey to answering this question is just beginning.

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A NOVEL FILTER BANK DESIGN FOR ENHANCED RADIO FREQUENCY (RF) HARVESTING AND ENERGY SYNTHESIS

Master of Technology in Telecommunication and Wireless Systems S. Garikayi
Eng. Magidi S., Eng. Musiiwa B.
Harare Institute of Technology, Harare, Zimbabwe

The quest for green and sustainable energy has risen over the years. Traditional energy sources like fossil fuels and nuclear power pose a threat to the environment and to life on Earth. Renewable energy has become a popular alternative source [1]. Much improvement has been done in solar energy. Other sources, such as piezoelectric, radio frequency harvesting and gyroscopic harvesting, are still under research. There's slow progress in developing a meaningful RF energy source. Radio frequency energy harvesting is going to revolutionise the future as Internet of Things technology is growing rapidly. It is the source intended to power low-consumption Internet of Things (IoT) devices such as sensors, wearables, smartphones and even unmanned aerial vehicles. The available RF harvesters lack efficiency in energy synthesis, resulting in very low voltage output and minimum use. The latest development by Powercast has 75 % efficiency but can charge up to 24 m [2]. Perseverance seeks to mitigate these

critical challenges and greatly improve RF harvesting. We present a novel filter bank architecture and implementation on RF energy harvesting techniques. In our design we leveraged the advantages of microstrip, passive and active filters to achieve a wider bandwidth. Filters play a very important role in signal processing and have been widely adopted in the applications of digital signal processing (DSP). Modern filters use advanced technology, typically well suited for the evolving software. They have unique characteristics due to their reconfigurability and programmability, and it is performed by a single chip. However, in RF harvesting, even analogue filters are still important because, in other filter applications, unwanted noise increases the voltage. Therefore, significant analogue and RF components are still needed to fulfil the bandwidth requirements. The filter bank presented in this paper is composed of four bandpass filters in the range of low frequency (LF), high frequency (HF), very high frequency (VHF) and ultra-high frequency (UHF). We performed rigorous experiments and simulations using MATLAB and AWR tools. The final results revealed significant improvements in RF harvesting and energy synthesis; the prototype was designed. This innovation will see the extinction of phones having chargers or charging ports. They will be capable of self-powering and charging.

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DESIGN AND DEVELOPMENT OF LOW COST IOT BASED SENSOR NETWORK FOR ENVIRONMENTAL MONITORING. A TECHNICAL ANALYSIS

Student, Master of Technology Degree in Industrial Automation Gweshei C. K.
Lecturer, Eng. K. B. Chimonyo
Harare Institute of Technology, Harare, Zimbabwe

The Internet of Things (IoT) has transformed the way we interact with our physical environments through the development of wide range of sensor networks. These networks enable users to monitor and control various parameters in real time, providing critical data for decision-making in multiple domains. The applications of IoT sensor networks extend to various fields, which include industrial automation, smart cities, and healthcare, showcasing their versatility and importance. IoT sensor networks are made up of interconnected devices that collect, transmit, and analyze data from their environment. Such networks typically include a variety of sensors, such as temperature, humidity, air quality, and noise level sensors. The integration of these sensors enables comprehensive monitoring of environmental conditions, thus enable timely responses to changes or anomalies.

In industrial automation, IoT sensors monitor equipment performance, environmental conditions, as well as energy consumption, leading to improved efficiency and reduced downtime. Urban environments, or smart cities, utilize IoT sensor networks for traffic management, waste management, and public safety, as result contribute to enhanced quality of life for residents. In healthcare, IoT devices track patient vitals and environmental conditions in hospitals, enabling better patient monitoring and timely interventions. This paper proposes a low-cost IoT-based sensor network specifically designed for environmental monitoring. The system integrates many different sensors to capture real-time data on various environmental parameters. The main features of the proposed system include the integration of temperature, humidity, air quality, and noise level sensors to gather comprehensive environmental data, as well as the transmission of sensor data to a cloud-based server using Wi-Fi communication protocols, ensuring accessibility and ease of use. Users could access and analyze the collected data through a dedicated mobile application, providing insights into environmental conditions and trends.

The evaluation of the proposed system involves a comprehensive technical analysis that includes performance metrics, data analysis, and energy efficiency. The system's performance is assessed based on response times, data accuracy, and reliability of sensor readings. The gathered data is subjected to various analytical techniques to deduce actionable insights, facilitating better decision-making. Further-