REPUBLIQUE DU SENEGAL
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MINISTERE DE L'ENSEIGNEMENT SUPERIEUR,
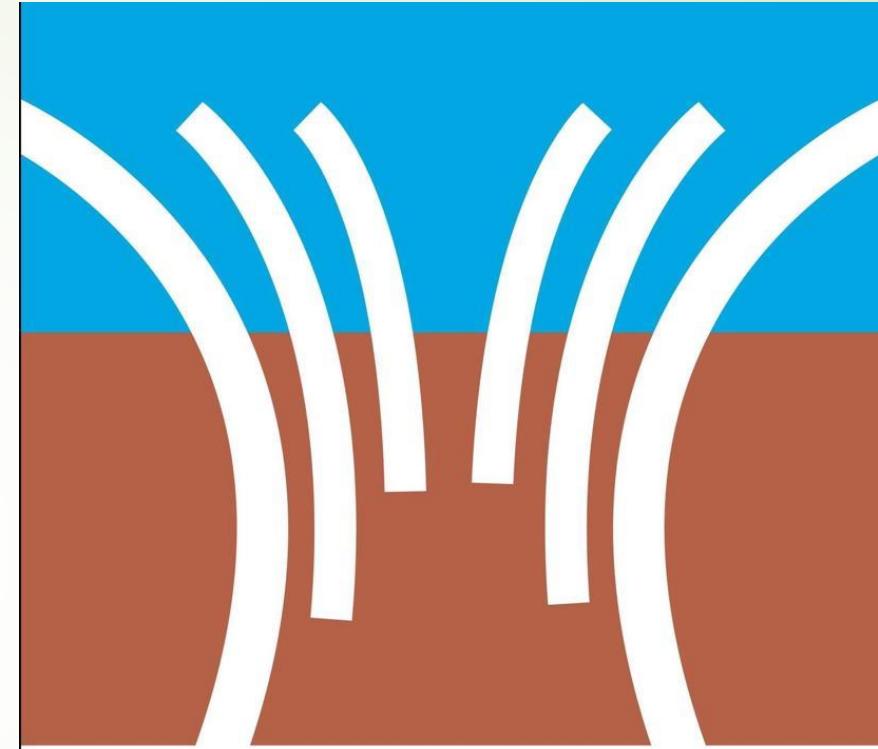DE LA RECHERCHE ET DE L'INNOVATION

THEME: Smart Buoys for Real-Time Monitoring of Water Quality and Marine Biodiversity

Exposant:

CHERIF EL VALID FALL

UFR SCIENCES ET TECHNOLOGIES AVANCEES (UFR STA)
DEPARTEMENT SMU

UNIVERSITE
AMADOU MAHTAR MBOW
DE DAKAR

Plus qu'une formation, un avenir à construire

. Field(s) of Activity

Marine Sciences and Coastal Management

Environmental Monitoring

Internet of Things (IoT)

Climate and Biodiversity Conservation

Data Science and Smart Technologies

INTRODUCTION

- Senegal's coastal and marine ecosystems are under increasing pressure from pollution, climate change, and human activity. Monitoring these environments in real time is essential to protect biodiversity and ensure sustainable resource management. This project proposes the development of smart buoys equipped with sensors to collect and transmit data on water quality and marine life along the Senegalese coast. By combining marine science and smart technology, this solution will help researchers, authorities, and communities better understand and protect our oceans.

1. General Objective

The general objective of this project is to develop and implement a smart buoy system that allows real-time monitoring of water quality and marine biodiversity along the Senegalese coast. This system aims to provide reliable environmental data that can support scientific research, guide public policies, and promote sustainable management of marine and coastal ecosystems.

2. Specific Objectives

To achieve the main goal of this project, several specific objectives have been defined. First, the project aims to collect and analyze real-time data on essential water parameters such as pH, temperature, salinity, oxygen levels, and turbidity. In addition, it seeks to detect the presence and movement of marine species using integrated acoustic and visual sensors. Another key objective is to build a centralized database that will allow long-term tracking of the marine ecosystem's evolution. The project also intends to support scientific research and assist public authorities in making informed decisions regarding marine resource protection. Finally, it aims to raise awareness among local communities and stakeholders about the importance of marine conservation through access to reliable environmental data.

3. Implementation Strategy

- To ensure the success of this project, a well-structured implementation strategy will be adopted. The first step involves the design and prototyping of low-cost, solar-powered smart buoys equipped with IoT sensors. These buoys will be capable of measuring various physical, chemical, and biological parameters of coastal waters. The next phase will focus on integrating reliable sensors that can monitor indicators such as temperature, salinity, pH, dissolved oxygen, and the presence of marine species. Once the buoys are operational, data will be transmitted in real-time to a cloud-based platform using GSM, 4G, or satellite communication technologies. A digital dashboard—accessible via mobile and web interfaces—will then be developed to allow users, researchers, and policymakers to visualize and analyze the data. The system will first be tested in selected pilot zones such as Saint-Louis, Dakar, or Casamance. Finally, the project will involve training sessions and outreach activities to engage local communities and academic institutions, ensuring active participation and long-term sustainability.

4.Expected Results / Positive Impacts

- The implementation of this project is expected to bring several positive and impactful results. First, it will provide real-time access to crucial environmental data, enabling early detection of pollution or disturbances in marine ecosystems. This continuous monitoring will improve our understanding of coastal waters and support the development of effective conservation strategies. The project will also enhance the decision-making capacities of environmental authorities by offering reliable scientific data. Furthermore, it will empower students, researchers, and local communities by involving them in environmental monitoring and education. In the long term, this initiative will contribute to the preservation of marine biodiversity, promote eco-innovation, and support the growth of the blue economy in Senegal.

5.Final Beneficiaries of the Project

➤ This project will benefit a wide range of stakeholders. Environmental agencies in Senegal, such as the Department of Environment and ANAM, will gain access to accurate data that will help them monitor and protect marine ecosystems more effectively. Coastal and fishing communities will also benefit, as the system will contribute to preserving the natural resources they depend on for their livelihoods. Universities and research centers will have access to valuable real-time data for scientific studies and educational purposes. In addition, NGOs working in marine conservation will be able to use the data to support their advocacy and field activities. Finally, students—especially those in marine sciences and technology—will benefit through hands-on learning opportunities and increased awareness of environmental challenges.

6.Potential Partners

- To successfully implement this project, collaboration with various strategic partners will be essential. Academic institutions such as UCAD, IFAN, and UAM can contribute through research support, technical expertise, and student involvement. Government bodies, including the Ministry of Environment and Sustainable Development, can provide regulatory guidance and institutional support. Oceanographic research institutes like IRD and CRODT can assist with scientific validation and field deployment. International organizations such as the United Nations Environment Programme (UNEP) and the World Wide Fund for Nature (WWF) may support the project through funding, advocacy, and global networking. Additionally, partnerships with tech startups and companies specializing in IoT or marine technology will be crucial for the development and maintenance of the smart buoy system.

7.Risk Analysis

- Like any technological and environmental initiative, this project may face several risks. One of the main risks is damage to the buoys caused by harsh sea conditions; to mitigate this, the buoys will be built using resistant materials and anchored securely. There is also a risk of sensor malfunction or data loss, which can be addressed through regular maintenance and the use of backup systems. A lack of community engagement could limit the project's impact; to prevent this, awareness campaigns and training sessions will be organized to involve local populations. Additionally, technical limitations may arise due to a shortage of skilled personnel, which will be tackled through capacity-building workshops. Finally, insufficient funding could slow down the project's progress, so multiple funding sources and partnerships will be explored to ensure financial sustainability.

conclusion

- In conclusion, this project offers an innovative and sustainable solution to the growing environmental challenges affecting Senegal's coastal and marine ecosystems. By combining marine science with smart technology, the smart buoy system will provide real-time data essential for research, policy-making, and community awareness. It not only supports the protection of marine biodiversity but also promotes local engagement and technological advancement. With strong partnerships and proper implementation, this project has the potential to become a key tool for preserving Senegal's valuable marine environment for future generations.

   As a personal commitment, I solemnly promise to dedicate my knowledge, energy, and integrity to the success of this project, and to actively contribute to the protection and sustainable development of our coastal and marine ecosystems.