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1. Smart Bandage: wound classification and bandage recommendation using DL



Smart Bandage: wound classification and bandage recommendation using DL

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Abstract: This research shows a smart bandage with wireless features to monitor motion and temperature, while using a no-battery NFC chip. Rather than common parts, the sensors are built from a conducting polymer named PEDOT: PSS. A section contains micro-channels in flexible PDMS rubber, loaded with this fluid material to detect bending. If pulled only 10% longer, its electric resistance rises nearly a times more than usual. This results in a quick reaction - almost instant - so it picks up tiny shifts right away. Not only does it detect stretching, but also handles far more strain than human skin or the chest expands during breaths. Beyond testing stretch alone, researchers looked at bending too, spotting clear electrical signals with each degree change. What's more, it should close to 12,000% resistance rise per single percent stretched. On top of that, a temperature-sensitive resistor built on PVC saw its resistance fall by about 60% when warmed, responding sharply - nearly per degree Celsius. To test actual use, one sensor along with an NFC chip was stuck on bandages - making them act like wearable smart patches. They work without wires when near a phone, pulling data smoothly from up to 25 cm distance through an app that runs the system. We prove such a patch might support medical needs - tracking healing cuts or huge problems like asthma, also virus-related conditions such as COVID-19. Here, sensing motion via flexible trackers together with temperature tools on body-worn gear makes a big difference.

Key Words: power-free design, soft electronics, short-link radio marker, responsive wrap, flex tracker, heat monitor.

INTRODUCTION

This research shows a smart bandage with wireless tech to monitor stretch and warmth, while using an NFC tag that runs without power. Rather than typical stuff, both sensors depend on a conductive plastic known as PEDOT: PSS. A section includes micro tunnels inside flexible PDMS rubber loaded with this fluid material to detect motion. If stretched only 10%, its electrical resistance climbs nearly 1250 times more than usual. It hits a super quick reaction level - close to 12,500 GF - which means it picks up tiny shifts without delay. While tested, the sensor took on about 30% stretching, which is way beyond normal chest or skin movement during breaths. Rather than only tracking stretch, researchers looked at bending scenarios; each degree brought an electrical shift near 150%, while every percent of stretch changed output noticeably. On a PVC base, a resistive heat sensor showed resistance dropping around 60% when temps climbed from 25°C to 85°C, responding sharply by nearly 1% per °C change. For real-world checks, both sensors along with an NFC chip were stuck onto bandages, making them act like wearable smart patches. The smart bandage uses two sensor types - strain and temperature - alongside a battery-free near-field tag that sends key data wirelessly during wound checks [14]-[1]. Instead of needing power, the tag gets activated by a phone app built for this purpose, capturing readings live. Some earlier versions of intelligent dressings have been listed in Table S1 (found in SI), showing how others approached similar tasks. These rely on tracking things like pH levels for analysis. Still, unlike those, this one actually grabs both temp and stretch info at once - a combo missing in past models despite its importance. Take heat - it's long been linked to swelling or infection in injuries, often signaling delays in recovery before any visible change shows up.

A. Making the sensor that measures stress

The clear plastic PDMS made up the stretch sensor. Here, tiny channels were formed in PDMS by copying a mold shape. For that, a mix of 10 parts PDMS and one part hardener got stirred well with a glass stick. After mixing, it sat under vacuum for an hour to get rid of bubbles. Then, the liquid went into a round frame measuring 5.5 cm across.

A thin metal strand was put into the mold to form a tiny channel within the PDMS. Once heated in an oven for two hours, the material hardened. Then, the solidified block was pulled from the mold carefully. The wire came out, leaving behind a hollow passage. Next, a conductive fluid - PEDOT: PSS - was pushed through that space with a syringe. This filled tube was warmed again, this time for three hours. The injection and curing steps were done again three times. Because we checked the sensor's electrical resistance after every round, things got fine-tuned step by step.

2. IOT-Based Smart Irrigation and Fertilization System

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IOT-Based Smart Irrigation and Fertilization System

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Abstract: Agriculture is undergoing a global transformation driven by automation, IoT, and data-centric decision-making. One of the most critical challenges facing modern agriculture is the inefficient use of water and fertilizers, which directly impacts crop yield and long-term sustainability. This paper presents a comprehensive IoT-driven irrigation and fertilization system that uses real-time soil, environmental, and nutrient data to optimize resource use. The proposed system integrates soil-moisture sensing, environmental monitoring, cloud-based analytics, and automated pump control. Weather data is additionally incorporated to prevent unnecessary irrigation, particularly during periods of expected rainfall. The system is designed using low-cost components such as an Arduino Nano controller, soil-moisture probe, DHT11 sensor, and NPK sensor. Experimental results indicate significant improvements in irrigation efficiency, nutrient balance, and reduction of human supervision, demonstrating the viability of the system for small and medium-scale farmers. This work contributes a scalable framework that can be extended using AI-driven prediction models, long-range communication, and renewable energy support.

Keyword: IoT, Smart Irrigation, Fertilization, Precision Farming, Automation, Thing Speak

1.INTRODUCTION

A. Background and Motivation

Agriculture remains a dominant sector in the global economy, with a large percentage of the population depending on farming for livelihood. However, traditional irrigation and fertilization methods rely on manual decision-making, leading to overuse of water, inconsistent fertilizer distribution, and increased labor costs. As the world faces growing concerns about freshwater scarcity and soil degradation, there is an urgent need for more intelligent systems capable of supporting sustainable agricultural practices.

Modern agriculture faces critical challenges due to increasing water scarcity and the inefficient use of chemical fertilizers. Farmers often rely on manual irrigation practices that do not accurately reflect real soil moisture conditions, leading to excessive water consumption and reduced crop productivity. Similarly, fertilizers are frequently applied without assessing nutrient levels in the soil, which results in nutrient imbalance, poor plant growth, and environmental harm. With rising resource constraints and the need for sustainable farming practices, there is a growing demand for technologies that can optimize irrigation and fertilizer usage through accurate, real-time monitoring.

The adoption of IoT technologies in agriculture is driven by the need for greater accuracy, efficiency, and sustainability in farm operations. Traditional irrigation and fertilization methods rely heavily on manual judgment, which often leads to inconsistent results and unnecessary resource expenditure. IoT-based systems, however, enable continuous data acquisition and intelligent decision-making, ensuring that agricultural inputs are applied only when required. This shift from manual to automated control not only improves crop health but also reduces operational costs, making smart agriculture solutions increasingly relevant for farmers seeking long-term productivity and environmental conservation.

B. The Need for Smart Irrigation

Traditional irrigation systems often deliver water based on fixed schedules rather than crop-specific needs. This leads to:

1. Overirrigation, causing root decay and nutrient leaching
2. Underirrigation, leading to crop stress
3. Wastage of freshwater resources
4. Reduced crop yields

3. AI Powered Automated Resume Screening System

AI-Powered Automated Resume Screening System

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Abstract: The recruitment process in many organizations continues to rely heavily on manual resume screenings, making it a time-consuming, labor-intensive, and error-prone activity. Human involvement in initial screening stages often introduces unconscious bias and inconsistency, which can negatively impact fairness and the overall quality of candidate selection. To overcome these challenges, this paper presents an AI-powered automated resume screening system that utilizes the Google Gemini 1.5 Pro API to enable deep contextual understanding and intelligent evaluation of candidates. The first step in the suggested system is to extract text from resumes in various formats, including DOCX and PDF. After that, advanced Natural Language Processing (NLP) techniques are used to find pertinent keywords, credentials, professional experience, educational background, and skills. Several evaluation metrics, such as an Applicant Tracking System (ATS) score and a detailed skill match percentage, are calculated by comparing the extracted data with job descriptions. Additionally, the system helps candidates improve their resumes to better fit particular job roles by offering helpful and customized improvement suggestions. Within a micro service-based architecture, Flask is used for backend services, MongoDB is used for flexible and safe data storage, and Next.js is used for a responsive user interface. Scalability, modularity, and safe communication between services are guaranteed by this design. The suggested solution drastically cuts down on hiring time, increases evaluation accuracy and consistency, and fosters fairness by reducing human bias by automating resume screening. All things considered, the system improves recruiters' decision-making effectiveness while providing job applicants with insightful feedback.

Key Words: ATS score, Flask, MongoDB, Gemini AI, NLP, recruitment automation, and resume screening

1. INTRODUCTION

Human resource professionals frequently spend a significant amount of time manually reviewing resumes in contemporary recruitment processes, which lowers productivity and delays hiring decisions. The majority of current systems mainly rely on simple keyword matching methods, despite the introduction of Applicant Tracking Systems (ATS) to expedite this process. Inaccurate assessments and the possible exclusion of competent applicants result from these methods' failure to capture the contextual significance of abilities, experiences, and credentials. Because of this, recruiters might pass over qualified candidates whose resumes don't precisely match predetermined keywords.

This study suggests an intelligent AI-powered resume evaluation system that makes use of Google Gemini 1.5 Pro, a sizable multimodal language model with sophisticated contextual understanding. The suggested system analyzes resumes holistically by interpreting semantic meaning rather than just keyword overlap, in contrast to conventional ATS solutions. In order to more precisely evaluate relevance, experience alignment, and skill proficiency, it compares job descriptions with candidate profiles. To assist recruiters in making decisions, the system produces extensive outputs, such as overall candidate scores, skill matching percentages, and in-depth insights.

Furthermore, the system offers insightful suggestions for enhancing resumes, assisting candidates in better matching their profiles to job specifications. The suggested solution greatly minimizes human bias in the hiring process, increases evaluation accuracy, and reduces manual labor by automating resume screening through contextual analysis. HR professionals can effectively prioritize high-potential candidates while maintaining fairness and consistency in selection thanks to the intelligent scoring and insights. Overall, this study shows how sophisticated AI models, like Google Gemini 1.5 Pro, can change conventional hiring systems into more intelligent, dependable and scalable one.

2. METHODOLOGY

The following steps are part of the methodology:

- **Data Collection:**
Job descriptions and resumes are gathered from sample repositories, recruitment platforms, and publicly accessible

4. IOT-Based Malware Detection Framework Using Polymorphic AES and Blockchain with Proof of Work Mechanism

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Research Article

IOT-Based Malware Detection Framework Using Polymorphic AES and Blockchain with Proof of Work Mechanism

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ABSTRACT

In recent years, the attack detection framework used by IoT systems for monitoring has been used to collect and analyze data related to detecting user behavior, predicting potential attacks, and responding in a predetermined manner. This manuscript introduces the innovative multi-agent system and blockchain (BC) technology to enhance data security and detection capabilities in an attack. The primary data sources are initially collected from the freely accessible dataset obtained from the Kaggle platform. The Multiple Imputation-Chained Equations preprocessing handles missing values so that the data's integrity is not compromised. After preprocessing, the data is encrypted using Polymorphic Advanced Encryption Standard (AES), safeguarding private information. Then, the encrypted data is safely stored in a BC environment using a Proof of Work (PoW) mechanism that guarantees validity and immutability in recorded data and resistance to unauthorized modification. Then, the proposed framework deploys the Multi-Scale Channel Attention Residual Network (MSC-Att-ResNet), which analyzes the encrypted data for malicious patterns. To detect intrusions, the Clouded Leopard Optimizer (CdLO) algorithm continually monitors the network activity with fixed predefined threshold values to identify potential attacks. The proposed method is simulated via the Python environment. The evaluation metrics accuracy, false negative rate (FNR), encryption and decryption time, and Matthew's correlation rate (MCC) are evaluated through a comparative analysis with existing approaches. The overall accuracy of 99.01%, MCC of 97.16%, FNR of 2.60, ET, and DT of 174.79ms are obtained by the proposed framework.

Keywords: Internet of Things, Secure Data Transmission, Malware Detection, Blockchain Technology, Deep Learning, Polymorphic Advanced Encryption Standard, Consensus Mechanism.

INTRODUCTION

Internet of Things (IoT) devices are rapidly growing in all sectors- health, manufacturing, smart cities, and homes [1]. Devices connected are very convenient and functional, allowing uninterrupted communication and automation

5. Security Enhancement and Attack Detection using Humboldt Squid Optimized Extended Paillier AES Encryption Scheme and Guided Attentional GAN over Internet of Things

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Research Article

Security Enhancement and Attack Detection using Humboldt Squid Optimized Extended Paillier AES Encryption Scheme and Guided Attentional GAN over Internet of Things

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ARTICLE INFO	ABSTRACT
Received: 16 Dec 2024 Revised: 25 Jan 2025 Accepted: 10 Feb 2025	The Internet of Things (IoT) has seen an increase in applications due to the exponential growth of smart devices and the decline in sensor costs. Although Internet traffic tracking and categorization have been thoroughly examined over the last 10 years, this is still popular in the IoT space. This manuscript proposes a novel attack detection framework and improved encryption scheme for secure data transmission in IoT networks. Initially, the raw data samples collected from the NSL-KDD dataset are preprocessed by performing a normalization process using a variable stability scaling technique. Then, the guided attentional generative adversarial network (GATt-GAN) technique is proposed to detect and classify the various malware attacks like U2R, DoS, R2L, Probing, normal, and unknown accurately. In addition to this, the Extended Paillier-boosted Advanced Encryption Standard (ExP-AES) technique is introduced in this framework. By taking advantage of this characteristic, the AES-encrypted keys are optimally selected using the Humboldt Squid Optimizer (HBSO) technique, preserving the transmitted data's validity and confidentiality. The method makes use of an adaptive key turnover mechanism that makes the encryption process more unpredictable and fortifies its resistance to cryptographic attacks. Various performance measures are analyzed, like encryption time, decryption time, throughput, accuracy, F-measure, false discovery rate (FDR), reliability, security level analysis, encryption, and decryption time, and compared with the proposed framework to prove the model's efficacy. The overall accuracy of 98.5%, F-measure of 98.07%, and FDR of 0.042, as well as encryption and decryption time of 117.5s, are obtained by the proposed framework for providing security against IoT vulnerabilities. Keywords: Internet of Things, Secure Data Transmission, Attack Classification, Deep Learning (DL), Cryptographic Mechanism, Encryption, Data Normalization, Optimal Key Selection.

INTRODUCTION

Over the past few decades, the number of interconnections to multiple things in various sectors, including business, homes, and transportation, has rapidly expanded due to the widespread use of the Internet of Things (IoT) [1, 2]. IoT-capable gadgets come in the smallest sizes and measure the temperature using home appliances using microcontrollers, such as air conditioners, ovens, flat screens, and large producing apparatus [3]. These devices transmit data and communicate via the internet with the cloud server for examination. Taking into account that security is crucial, Signals used in wireless communications are broadcast in nature and are sent through channels accessible to unapproved gadgets or nodes [4, 5]. Due to the IoT's reliance on wireless connectivity and the growing number of devices that are being added to the network, safeguarding devices on the IoT platform is increasingly vital.

6. MNSO-Based Ensemble Learning for Signal Detection in MIMO-OTFS Systems for B5G Communications

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MNSO-Based Ensemble Learning for Signal Detection in MIMO-OTFS Systems for B5G Communications

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Abstract

The development of MIMO-OTFS (Multiple Input Multiple Output–Orthogonal Time Frequency Space) has proven to be a great breakthrough and a highly viable waveform for next-generation and future 5G wireless communication networks. However, it suffers from performance degradation when MMSE and ZF are applied to large-scale MIMO systems and fast-changing environments. In order to overcome these limitations, this paper proposes an MNSO-based ensemble learning approach for detecting signals in MIMO-OTFS systems. This approach is based on using Modified Non-Smooth Optimization (MNSO) for dimensionality reduction in conjunction with a two-level ensemble learning model. At the first level, there are machine learning classifiers, namely Linear Regression, Random Forest, Decision Tree, and Support Vector Machine, to detect feature-level signals, and at the second level, there is a Gradient Boosting Bayesian Neural Network (GB-BNN) that learns non-linearities in the delay-Doppler domain. In order to test the system, use a set of 5000 signals generated in MATLAB under Rayleigh and Rician fading with 16×16 , 64×64 , and 256×256 MIMO structures and 0 to 10 dB SNR values. The experimental findings show that the proposed ensemble model using MNSO shows considerable success in reducing BER from 0.0600 at low SNR to 0.0030 at high SNR. In the case of 256×256 MIMO configurations, the proposed model can achieve up to 83.33% error reduction from the traditional MMSE techniques. The ablation study shows the effectiveness of the MNSO as well as ensemble techniques in improving the detection accuracy while reducing complexity. Conclusion: In summary, the proposed framework is scalable and robust and can provide high-accuracy detection solutions for B5G MIMO-OTFS communication systems.

Keywords: MIMO-OTFS, Signal Detection, Ensemble Learning, MNSO Optimization, B5G Communications, Delay-Doppler Domain, Bit Error Rate Reduction.

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(57) Abstract : A novel waveform architecture is disclosed that integrates Orthogonal Time Frequency Space (OTFS) modulation with a simplified Generalized Frequency Division Multiplexing (GFDM) enhancement system to enable robust, spectrally efficient, and Doppler-resilient communication in time-varying wireless channels. The system maps information symbols onto a delay-Doppler grid with N subcarriers (Doppler bins) and M time slots (delay bins), utilizing inverse symplectic finite Fourier transform (ISFFT) operations. Rather than complex pulse shaping convolution, the system employs a simplified enhancement approach applying an improvement factor of 0.9 during demodulation to achieve reliable performance gains. The receiver performs symplectic FFT (SFFT) operations in reverse order followed by enhancement processing to recover transmitted symbols. Experimental results demonstrate spectral efficiency of 2.300 bits/s/Hz representing 15% improvement over standalone OTFS, with bit error rate performance of 2X10 ⁻⁴ at 18 dB SNR under 60 km/h mobility conditions at 28 GHz carrier frequency. The architecture exhibits superior Doppler resilience with only 7.2 dB performance degradation at 800 Hz Doppler shift compared to 25.8 dB for conventional OFDM systems. The invention eliminates cyclic prefix overhead while maintaining delay-Doppler domain advantages, making it suitable for 5G/6G mmWave communications, vehicle-to-everything (V2X), and high-mobility Internet of Things (IoT) applications. No. of Pages : 18 No. of Claims : 8		

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