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RESEARCH ARTICLE

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DISASTER MANAGEMENT AND MONITORING SYSTEM FOR DAMS USING IOT APPLICATIONS

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ABSTRACT

The adoption of cloud computing is increasingly favored by researchers and innovators globally, particularly in the advancement of Information and Communications Technology (ICT) infrastructures. This trend is particularly evident in the push for smart city development. However, there are always unpredictable forces and natural disasters that pose challenges to technological progress. This paper explores one such common disaster that affects both urban and rural areas - floods. The paper suggests that flood management and early warning systems can be enhanced through the use of cloud computing. With the continuous evolution of cloud computing, it is anticipated that integrating Green Cloud technology will further promote environmentally friendly practices in smart cities for a better quality of life.

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INTRODUCTION

The advancements in Information and Communications Technology (ICT) have been continuously evolving with the advent of cloud computing. The concept of "the Cloud" can be traced back to the early days of computer development, starting from the era of mainframes in the 1950s, followed by the introduction of mini computers and personal computers in the 1970s. The 1990s witnessed the rise of networked personal computers, while the 2000s brought the era of smartphones. And now, the Cloud has become an integral part of our technological timeline. The primary idea behind IoT revolves around the communication between machines. Recently, there has been a growing interest in internet-based sensor networks. These networks involve connecting sensors to the internet, allowing the gathered information to be transmitted to a server. However, there are significant challenges related to the security, manageability, and wireless connectivity of these sensors. Despite these challenges, IoT systems are currently being utilized for various purposes such as remote recording and monitoring of family and friends, climate change notifications, traffic updates for local roads, and railway arrival and departure notifications. Differential pressure sensors are installed at regular intervals along the primary pipeline. These sensors are capable of detecting any pressure variations caused by pipeline breaks or leaks. Once a pressure difference is detected, the information is immediately relayed to the observer. In the event of a flood, the flow of floodwater can be efficiently directed by considering the water levels at different dams. To monitor the areas surrounding the dams, cameras are utilized. These cameras transmit live footage to a central base station, aiding in the identification of individuals near the dams. This surveillance system ensures safety when releasing water during flash floods. The Internet of Things (IoT) technology plays a crucial role in enhancing the intelligence of sensor networks by connecting them to the internet. By collecting data on failed sensors, we can develop more reliable equipment, thereby improving the overall reliability of the dams. Integrating IoT with big data, cloud computing, and wireless sensor networks (WSN) further enhances the operational capabilities of the dams. All data processing is conducted in the cloud, ensuring faster and more reliable data retrieval and command issuance.With the rise of cutting-edge data analytics, service, and communication technologies like BDA, IoT, cloud computing, fog computing, etc., disaster management systems are poised to benefit from a multitude of new data sources and efficient data processing tools. These tools have the potential to enhance decision-making across all stages of a disaster - rescue, response, mitigation, and preparedness. The effectiveness of a disaster management system hinges on making appropriate and timely decisions based on accurate and current information. Applications that rely on real-time operations and high-speed data streams require robust streaming data analytics to achieve their objectives. By leveraging various data sources such as physical sensors and crowd-sourced information, disaster management systems can access a broader range of data, enabling more effective analytics and yielding better results and insights. The combination of increased communication through Web 2.0, the integration of diverse data sources (social media, IoT sensors, satellites, smartphones, public data repositories, etc.), and the availability of powerful big data analytics tools (Hadoop, Spark, Kafka, etc.) with interactive visualization applications (Kibana, Tableau, Plotly, etc.) has the potential to revolutionize disaster management systems.

LITERATURE REVIEW

The control of water or liquid levels is a highly dynamic area, with numerous studies focusing on the implementation of fuzzy or neural networks for water level control systems. This involves the crucial tasks of measuring and regulating the water level. Submersible pressure transducers, also known as wet sensors, are commonly utilized to measure water level due to their ease of installation and minimal maintenance requirements. These sensors are frequently employed for temporary setups and in remote areas. It is crucial that they are permanently submerged in water and remain in a fixed position. The transducers operate by applying hydrostatic pressure to a strain gauge, which then transforms mechanical motion into an electrical signal. This signal is subsequently captured by the station data logger and translated into pressure, level, and discharge readings. Nowadays, the safety monitoring of large dams primarily relies on the assessment of crucial parameters such as absolute and relative displacements, strains, and stresses in the concrete, as well as discharges through the foundation. Additionally, visual inspections of the dam structures play a significant role. In some cases, the measured data is analyzed and compared with the outcomes of mathematical or physical models, aiding in the evaluation of structural safety. Artificial neural networks (ANNs) offer a rapid and adaptable approach to developing models for predicting river flow, demonstrating superior performance compared to traditional techniques. These networks are valuable for analyzing the typical structural patterns of dams by considering historical influences on the structure. Essentially, an artificial neural network consists of interconnected nodes, resembling the intricate network of neurons in the brain. Each node symbolizes an artificial neuron, with arrows indicating the flow from one node's output to another's input. Throughout its lifespan, a dam may experience significant fluctuations in water levels and seasonal changes in environmental temperatures. The key factor in water supply is ensuring the delivery of the required quantity of water while maintaining a minimum water head. It is essential to provide the necessary amount of water with sufficient pressure to meet the needs of the end consumers. Overhead storage tanks are constructed to maintain a constant water level, thereby ensuring a consistent pressure. However, consumer demand varies throughout the day, resulting in changes in the output flow rate of the tank. If water is supplied at a constant rate, it may lead to either an overflow of water or a drop in pressure at the end user's location. Therefore, effective water level management becomes necessary. A project was undertaken on the river Nile to establish national geo-referential databases and spatial layers. This involved collecting hydro-meteorological parameters, water usage information, land use data, land cover extent, and soil types. To enhance monitoring capabilities, advanced technologies such as automated weather stations and acoustic-based Doppler current profilers were introduced. These profilers, typically mounted on boats, effectively measure water flow without the need for expensive cableways. Additionally, two buoys were deployed on Lake Nasser in Egypt to measure water evaporation, providing a ground truth for satellite-based calculations. The data structure developed for this project has been adopted by most basin countries, ensuring seamless and rapid data exchange through proper sharing mechanisms. A standardized structure is also essential for the development of basin.

METHODOLOGY

Architecture: When an alert signal is received, modules switch to the disaster management mode. This alert signal is a preconfigured data packet that is utilized to change the mode of the modules. In this mode, one device functions as the host while other devices in the surrounding area connect to it. Among the connected modules, one acts as the server and receives input from all the modules connected to that access point. Once it successfully receives input from the remaining modules, the server module connects to the next hosted network nearby and transfers all the received data to the server module of that network. The server module continuously checks all networks in the vicinity and periodically establishes connections with each network to transfer collected data from the modules. As a result, a network of interconnected modules is established. A well-defined model for BDA- and IoT-based disaster management environment is lacking in the current literature. It is imperative to thoroughly examine various related reference models. The architecture of such an environment must be adaptable to accommodate all data sources, uniform to configure diverse network topologies for data communication, and conducive to retrieving the necessary results for efficient decision-making. Additionally, the architecture should be constructed to maintain the resilience of the environment, enabling it to withstand any disruptions caused by disasters. Designing a generic data model that integrates heterogeneous data while remaining flexible, efficient, and secure is a formidable task due to the multitude of data sources.

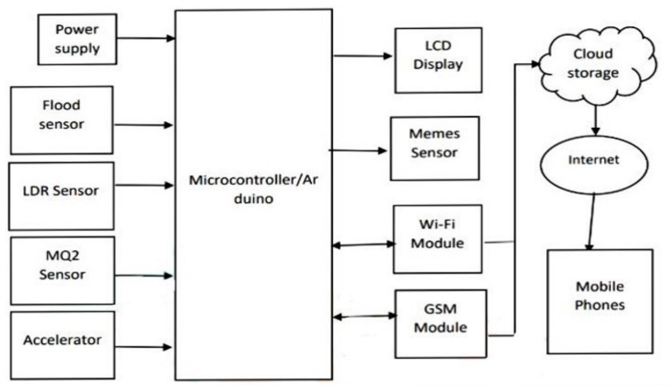

Fig. 1. Schematic Diagram

The system is comprised of various components and phases that combine modules to create the primary system. Our strategy involves utilizing microcontroller-enabled sensors, actuators, and a Wi-Fi transceiver module for collecting data and measuring the environmental conditions in the vicinity. This data aids in monitoring smart cities and managing disasters. The Wi-Fi module, ESP8266, serves as a comprehensive and self-sufficient Wi-Fi networking solution, enabling it to host applications or delegate all Wi-Fi networking tasks to another application processor. The modules operate on an addressing system where each node possesses a unique ID within the network. These nodes are interconnected in a star topology, capable of functioning as either a master or slave depending on the circumstances. The proposed hardware design is versatile and can be fitted with sensors or actuators tailored to the specific requirements of the location where they are deployed. An internal power supply is included to ensure uninterrupted operation in the event of a power failure. Additionally, a solar cell power supply is integrated for prolonged power outages. The Atmega 328 Pmicro controller serves as the core for programming and interfacing with various sensors, actuators, and communication using the Arduino firmware. The Arduino programming environment streamlines the developer's ability to manage, compile, and upload data. The ESP8266 Wi-Fi Module is a self-contained SOC that includes an integrated TCP/IP protocol stack. This module enables any microcontroller to connect to a Wi-Fi network [9]. It supports 802.11 b/g/n and offers Wi-Fi direct functionality, as well as the ability to function as a software-enabled access point. Designed specifically for mobile devices, wearable electronics, and networking applications, this module is a low power device with a built-in antenna. Communication with the module is achieved using communication standards such as SPI and UART. Additionally, the ESP8266 Wi-Fi module is cost-effective, making it an ideal choice for large-scale implementation. To utilize the Wi-Fi capabilities of the ESP8266, it is used as a Wi-Fi adapter for our microcontroller. The module is communicated with using the AT command set defined by the manufacturer, utilizing the UART interface. In order to ensure resilience during disasters, a system with three power sources has been proposed, allowing for seamless switching between power supplies based on the situation at hand. The key factors taken into consideration for designing the power supply were system voltage and the maximum current requirement. Given that our system utilizes a Wi-Fi adapter, it is essential to account for the burst current needed in wireless applications. Testing indicated that the ESP8266 necessitated a peak burst current of 200mA, with a maximum allowable voltage of 3.3V. Consequently, the operating voltage of our system was set at 3.3V, with the utilization of a voltage regulator to provide a constant, ripple-free regulated voltage. The LM1117, a 3.3V, 800mA low-dropout linear regulator, was selected as the voltage regulator due to its ability to meet the necessary parameters and minimize power loss thanks to its low dropout voltage. This optimization significantly enhanced the efficiency of our system, a critical factor in the event of external power loss. Our primary power source is the AC line, serving as the external power supply for the module. Through the use of a power adapter, the AC line is converted into 12V, 1A DC. Additionally, when accessible, the AC line is utilized to charge the internal battery. The internal power source of the module is a high-quality Lithium Polymer battery, employed in the absence of the external power supply. A third power supply is included for use in scenarios of disaster and calamity, particularly when the AC power line experiences prolonged outages. A high-capacity solar cell can be integrated into the module to offer a power supply even in cases of dislocation or damage. This solar cell not only powers the module but also charges the battery, ensuring continuous functionality even during nighttime.

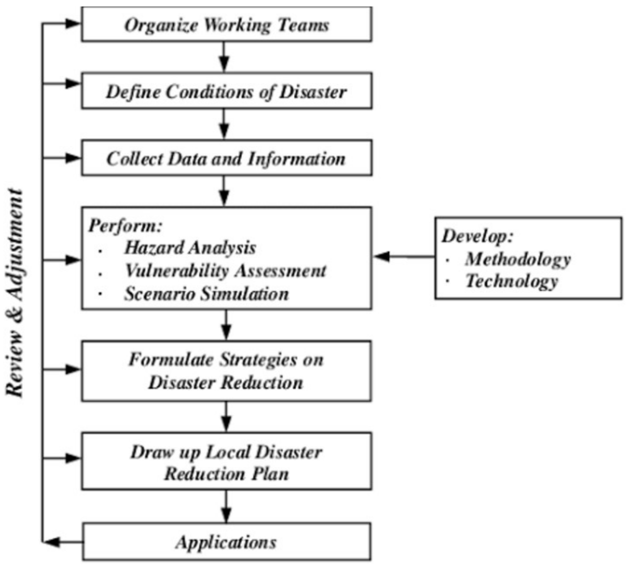

Fig. 2. Theoretical Flow

The Internet of Things (IoT) has revolutionized computing and communication by making them omnipresent, mobile, and wearable. This is made possible through the use of numerous microcontrollers and microcontroller platforms. One such platform is Arduino, which consists of a programming environment and Arduino boards. At the core of the module, the ATmega328PPU microcontroller is used. This microcontroller, developed by Atmel, is a high-performance, general-purpose 8-bit AVR RISC-based microcontroller. It supports various communication protocols such as UART, SPI, and 2-wire serial interface. Additionally, it has built-in analog to digital conversion capabilities, making it an ideal choice for central data acquisition in our system. The ATmega328 microcontroller is used in conjunction with the Arduino bootloader. Arduino is an open-source prototyping platform that offers user-friendly hardware and software. The code written on the Arduino IDE is easy to write and edit, providing a higher level of robustness. Arduino libraries further enhance its capabilities by allowing easy attachment and interfacing of a wide range of sensors and modules to our system. The main features of the Arduino platform, including its low cost, cross-platform compatibility, simple programming environment, open-source nature, and extensible software and hardware, make it highly suitable for real-time applications like our system. Depending on the specific application, multiple sensors can be interfaced with the module, enabling tasks such as monitoring atmospheric temperature. Our primary power source is the AC line, serving as the external power supply for the module. Through the use of a power adapter, the AC line is converted into 12V, 1A DC. Additionally, when accessible, the AC line is utilized to charge the internal battery. The internal power source of the module is a high-quality Lithium Polymer battery, employed in the absence of the external power supply. A third power supply is included for use in scenarios of disaster and calamity, particularly when the AC power line experiences prolonged outages. A high-capacity solar cell can be integrated into the module to offer a power supply even in cases of dislocation or damage. This solar cell not only powers the module but also charges the battery, ensuring continuous functionality even during nighttime. The Internet of Things (IoT) has revolutionized computing and communication by making them omnipresent, mobile, and wearable. This is made possible through the use of numerous microcontrollers and microcontroller platforms. One such platform is Arduino, which consists of a programming environment and Arduino boards.

RESULTS ANALYSIS

When an alert signal is received, modules switch to the disaster management mode. This alert signal is a preconfigured data packet that is utilized to change the mode of the modules. In this mode, one device functions as the host while other devices in the surrounding area connect to it.

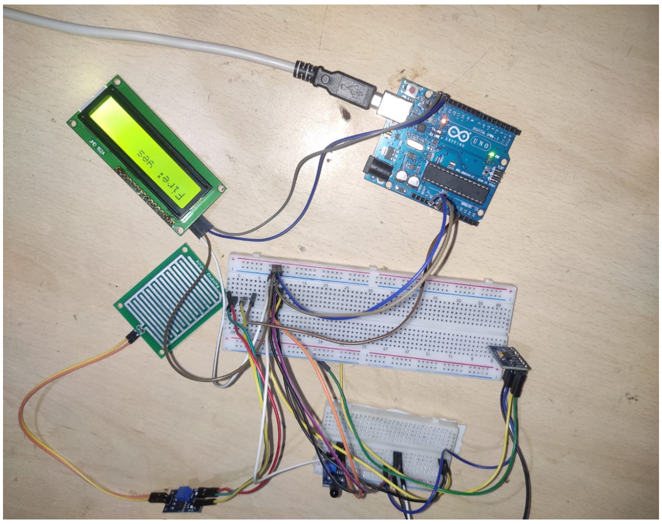

Fig. 3. Before detecting adisaster

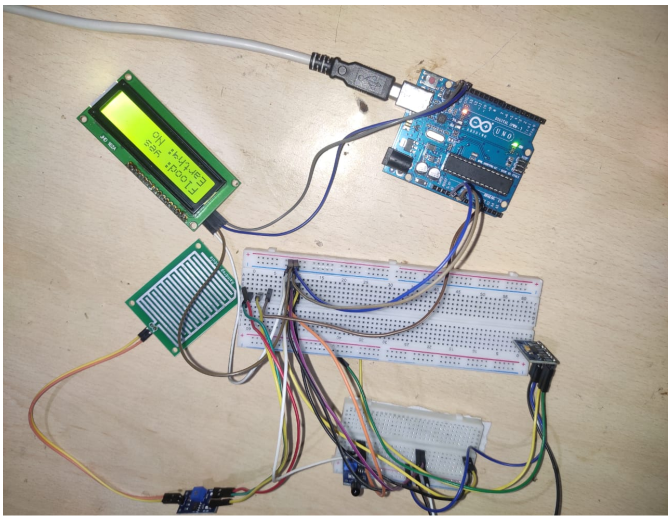

Fig. 4. After detecting adisaster, it alerts the user by alarming buzzer

Among the connected modules, one acts as the server and receives input from all the modules connected to that access point. Once it successfully receives input from the remaining modules, the server module connects to the next hosted network nearby and transfers all the received data to the server module of that network. The server module continuously checks all networks in the vicinity and periodically establishes connections with each network to transfer collected data from the modules. As a result, a network of interconnected modules is established.

CONCLUSIONS AND FUTUREWORK

The fusion of Big Data Analytics (BDA) and Internet of Things (IoT) offers a promising and more efficient approach to disaster management processes. By leveraging advanced big data analytical tools and well-managed IoT systems, we not only have the ability to gather large volumes of valuable data from various sources, but also generate real-time results for effective decision-making. However, further research is needed to effectively model and implement these two paradigms, taking into consideration the time constraints and accuracy requirements of disaster management processes.In this survey paper, we have identified the benefits of BDA and IoT in disaster management and examined the existing literature on their applications in this field. We have categorized the relevant literature by presenting a thematic taxonomy that highlights the main attributes of BDA and IoT-based disaster management environments. Additionally, we have provided a comprehensive overview of the architectural deployment of BDA and IoT-based disaster management environments through a reference model that includes dedicated layers for data generation, harvesting, communication, management and analytics, and applications. In conclusion, this survey paper can serve as a valuable guideline for understanding the overall functionalities and maximizing the opportunities associated with BDA and IoT in the development of an effective disaster management environment.

REFERENCES

A. Carter, Study Says Guests are Finding Hidden Cameras Inside Rental Properties Hotel Rooms, Jul. 2019.

Budzier, Helmut, and Gerald Gerlach. Thermal infrared sensors: theory, optimisation and practice. John Wiley & Sons, 2011.

Budzier, Helmut, and Gerald Gerlach. Thermal infrared sensors: theory, optimisation and practice. John Wiley & Sons, 2011.

Dao, Dinhnguyen, Muhammad Salman, and Youngtae Noh. "DeepDeSpy: A Deep Learning-Based Wireless Spy Camera Detection System." IEEE Access 9 (2021): 145486-145497.

GILMAN, LARRY. "Infrared Detection Devices| Encyclopedia. com (2023)."

Lagesse, Brent, et al. "Detecting spies in IoT systems using cyber-physical correlation." 2018 IEEE International Conference on Pervasive Computing and Communications Workshops (PerCom Workshops). IEEE, 2018.

Lee, Jihyeon, et al. "AI-aided Hidden Camera Detection and Localization based on Raw IoT Network Traffic." 2022 IEEE 47th Conference on Local Computer Networks (LCN). IEEE, 2022.

Liu, Ziwei, et al. "CamRadar: Hidden Camera Detection Leveraging Amplitude-modulated Sensor Images Embedded in Electromagnetic Emanations." Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies 6.4 (2023): 1-25.

Macrakis, Kristie. Espionage: A Concise History. MIT Press, 2023.

Mengxiao, Hidden Camera Found in H&M Store's Changing Room, Jul. 2017.

Murtaza Taj, Andrea Cavallaro: Multi-Camera Scene Analysis using an Object-Centric Continuous Distribution Hidden Markov Model, 2007 *IEEE International Conference on Image Processing*.

Pravin, A., et al. "Efficient Framework for Hidden Camera Detection & Jamming using IoT." 2022 6th *International Conference on Trends in Electronics and Informatics (ICOEI).* IEEE, 2022.

R. Kenner, Man Sues After Finding Hidden Cam in Hotel Bathroom, Sep. 2012

Salman, Muhammad, et al. "CSI: DeSpy: Enabling Effortless Spy Camera Detection via Passive Sensing of User Activities and Bitrate Variations." Proceedings of the ACM on Interactive, Mobile, Wearable and Ubiquitous Technologies 6.2 (2022): 1-27.

Sami, Sriram, et al. "Lapd: Hidden spy camera detection using smartphone time-of-flight sensors." Proceedings of the 19th ACM Conference on Embedded Networked Sensor Systems. 2021.

Thanha, Nguyen Thi Phuong. "Deepening researches on infrared rays principles, applications and products." *Turkish Journal of Computer and Mathematics Education (TURCOMAT)* 12.11 (2021): 5534-5537.

Waters, Darin J., Gene Hyde, and Kenneth Betsalel. "In-between the color lines with a spy camera: the Appalachian urban folk photography of Isaiah Rice 23.1 (2017): 92-113. ." Southern Cultures

Y. Cheng, X. Ji, T. Lu and W. Xu, "On detecting hidden wireless cameras: A traffic pattern-based approach", IEEE Trans. Mobile Comput., vol. 19, no. 4, pp. 907-921, Apr. 2020

Yu, Zhiyuan, et al. "HeatDeCam: Detecting Hidden Spy Cameras via Thermal Emissions." Proceedings of the 2022 ACM SIGSAC Conference on Computer and Communications Security. 2022.

Yu, Zhiyuan, et al. "HeatDeCam: Detecting Hidden Spy Cameras via Thermal Emissions." Proceedings of the 2022 ACM SIGSAC Conference on Computer and Communications Security. 2022.

Zuniga, Agustin, et al. "See No Evil: Discovering Covert Surveillance Devices Using Thermal Imaging." IEEE Pervasive Computing 21.4 (2022): 33-42.

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