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DETECTING DISASTER, SAVING LIVES WITH RFID AND AWS CLOUD

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Abstract

This project is focused on designing and implementing an IOT-based disaster monitoring system that can monitor water level, air conditions, and high-frequency vibrations in real-time. The system will use sensors to collect data, which will be stored in the AWS cloud. The system will also record any slight changes in the monitored parameters, allowing for early warning and timely response to disasters. The system will additionally utilize RFID technology to detect people who are trapped in disaster-prone areas. The data from the RFID will be uploaded to the cloud, providing real-time tracking of the affected individuals. The system's main goal is to enable effective disaster management, reduce damage caused by disasters, and save lives. The project is expected to contribute to advancing the field of disaster management and bring significant benefits to society.

Keywords-*IoT (Internet of Things),Sensors, Real-time monitoring,Naturaldisasters, Emergency,IOT- Cloud, Wireless networks, Remote sensing, Environmental monitoring, Sensor fusion*

1.Introduction

Earth quake, Flood,Cyclone is a natural disaster where an area of land that get instantly damaged lives. An earthquake is a sudden and rapid shaking of the earth's surface, caused by the shifting and movement of tectonic plates beneath the surface. Earthquakes can range from minor tremors to major, destructive events that can cause significant damage to buildings, infrastructure, and communities. The strength of an earthquake is measured on the Richter scale, which assigns a numerical value based on the magnitude of the shaking. Earthquakes can trigger other natural disasters such as landslides, tsunamis, and volcanic eruptions. Flood may occur in many areas in different ways due to overflow of streams, rivers, lakes or oceans or as a result of excessive rain A warning system is necessary to take precautionary measures and be more prepared to overcome its effects. A cyclone is a weather phenomenon characterized by strong, rotating winds around a center of low pressure. Cyclones can form over warm ocean waters and are fueled by the release of heat energy from the ocean. Cyclones are classified based on their wind speeds, with tropical cyclones being the most common type. Tropical cyclones, also known as hurricanes or typhoons, form over tropical and subtropical waters and can cause significant damage when they make landfall. Cyclones are accompanied by heavy rainfall, thunderstorms, and storm surges, which can cause flooding and landslides. This project aims at alerting the authorities about an imminent areas by monitoring the water level at flood proned areas ,change in air conditions ,high frequency vibrations which have high impact on that area. Every information is recorded and store in the AWS Cloud with is a RFID(Radio Frequency Identification) to send the alert message to the emergency contact provided data to the RFID.

2.Literature Survey

Large-Scale Automtic Vessel Monitoring Based on DualPolarization Sentinek-1 and AIS Data proposed by R.Pelich *et al*. This research proposes a method for ship detection and characterization from SAR data using dual-polar metric descriptors. The method uses automatic algorithms based on the dual-polarization coherence of Sentinel-1. The proposed methodology is tested on Sentinel-1 data acquired over two different areas, the English Channel and Pacific coastline of Mexico. The results show a high detection rate for vessels larger than 60m, and the complementarity of SAR in detecting dark vessels.

Earth observation applications for coastal sustainability: potential and challenges for implementation proposed by E. Politi, S. K. Paterson, R. Scarrott, E. Tuohy, C.
O'Mahony, and W. C. A. Cámaro-García. This article discusses the role of Earth observation (EO) in sustainable coastal management. While EO can provide much-needed spatiotemporal information for historical analysis and mapping, its uptake is limited by technical and methodological challenges, as well as governance issues. The article presents examples of how EO can contribute to decision-making in the coastal water zone, and discusses opportunities and challenges for a more solution-led approach to sustainable coastal management, framed by international agreements such as the United Nations Agenda 2030 and the Convention on Biological Diversity.

Shoreline Rotation Analysis of Embayed Beaches by Means of In Situ and Remote Surveys proposed by D. Di Luccio *et al*, This study aims to understand the possible rotation of embayed beaches in Italy over a 64-year period. Differential Global Positioning System (DGPS), GPS RTK, low-altitude aerial imagery, and satellite polar metric Synthetic Aperture Radar (SAR) measurements were used to collect data. Results suggest a correlation between coastline rotation and wave directional shift. The study also investigates the limitations of remote survey methods for identifying shoreline rotation.

A Hierarchical Split-Based Approach for Parametric Thresholding of SAR Images: Flood Inundation as a Test Case proposed by M. Chini, R. Hostache, L. Giustarini, P. Matgen, This study proposes a hierarchical split-based approach to parameterize distribution functions for SAR imagery thresholding algorithms. The method is integrated into a flood-mapping algorithm and tested using SAR images of a flood event along the Severn River in the UK. The results show promising classification accuracies and similarity to a benchmark method based on manual tile selection.

3. System Analysis

3.1 Existing System

The existing is real time flood monitoring system with Wireless Sensor Networks. We observed that this system cannot provide or measures the different environment conditions using Wireless Sensor Networks, and also noticed that the existing WSN of flash flood alerting cannot provide forecasting of future disasters. So in this case of floods it takes more time to send message to the people living in the nearest area so that the people could not save their lives. Usually the flood cannot be predicted but the early detection can be made it means the early alerting system with the help of continuous monitoring can be useful to reduce the loss caused by the floods& Earth quakes.

3.2 Proposed System

Smart Flood & Earthquake, Cyclones Monitoring System is developed to alert the public closest to the area when there is upcoming flood & Earthquake, Cyclone. The collected data from the sensor are gathered and will be forwarded to microcontroller and data will be stored in the AWS Cloud. Then, data will be analyzed and compared. This project will update the data collected and also the admin will able to details of the people who got stucked into disaster. The Server automatically sends an alert message to the emergency contacts.

4.Future Scope

Thus, an efficient and also a cheap solution to a real time Distaster monitoring and early warning system could be provided with plenty of potential for further improvements and optimization on the system side. It can further improved by sending messages to the publis places.These experiments were performed at the same camera distance and ambient weather condition. The effect of distance can be added in the next modification As a future modification one could integrate the

camera into an Unmanned Aerial Vehicle platform so that it can be used to analyze real time flood level by moving overwater and into remote areas, which is a more complex extension.

5.Methodology

The methodology of this project is focused on designing and implementing an IOT-based disaster monitoring system. The system will use sensors to collect real-time data on water levels, air conditions, and high-frequency vibrations. This data will be stored in the AWS cloud and analyzed for any slight changes, allowing for early warning and timely response to disasters. RFID technology will also be utilized to detect people who are trapped in disasterprone areas, and their data will be uploaded to the cloud for real-time tracking. The main goal of the system is to enable effective disaster management, reduce damage caused by disasters, and save lives. By utilizing this approach, we hope to contribute to advancing the field of disaster management and bringsignificant benefits to society.

6.System Design

The block diagram of the proposed System is consists of Accelerometer Sensor, Vibration Sensor, MQ 135 Sensor are the sensors to monitor the Flood, Earth Quake and Cyclones. The Arduino with Node mcu is to record the data send to the cloud. The ESP 8266 is Wi-fi Module to communicate with Cloud Server. Then RFID is used to detect the people who stuck during the disaster through sending them alert message to the emergency contact number.

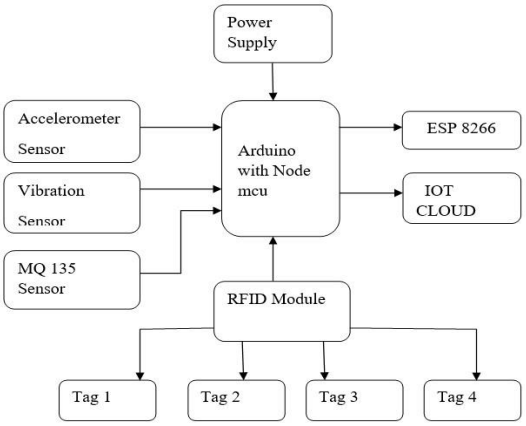

Figure 3 – Block Diagram

6.1Accelerometer sensor

An accelerometer sensor is a tool that measures the acceleration of any body or object in its instantaneous rest frame. It is not a coordinate acceleration. Accelerometer sensors are used in many ways, such as in many electronic devices, smart phones, and wearable devices, etc.

Figure 2 – Accelerometer sensor

6.2Vibration Sensor

A vibration sensor, or vibration detector, measures vibration levels in machinery for screening and analysis. Maintenance teams use industrial vibration sensors for condition monitoring, giving them insight into the magnitude and frequency of vibration signals.

Figure 3 – Vibration sensor

6.3MQ 135 Sensor

An MQ135 air quality sensor is one type of MQ gas sensor used to detect, measure, and monitor a wide range of gases present in air like ammonia, alcohol, benzene, smoke, carbon dioxide, etc. It operates at a 5V supply with 150mA consumption.

Figure 4 - MQ 135 Sensors

6.4RFID Module

EM18 is a RFID reader which is used to read RFID tags of frequency 125 kHz. After reading tags, it transmits unique ID serially to the PC or microcontroller using UART communication or Wieg and format on respective pins. EM18 RFID reader reads the data from RFID tags which contains stored ID which is of 12 bytes.RFID is an acronym for "radio-frequency identification" and refers to a technology whereby digital data encoded in RFID tags or smart labels (defined below) are captured by a reader via radio waves. RFID is similar to barcoding in that data from a tag or label are captured by a device that stores the data in a database. RFID, however, has several advantages over systems that use barcode asset tracking software. The most notable is that RFID tag data can be read outside the line-ofsight, whereas barcodes must be aligned with an optical scanner. If you are considering implementing anRFIDsolution.RFID belongs to a group of technologies referred to as Automatic Identification and Data Capture (AIDC). AIDC methods automatically identify objects, collect data about them, and enter those data directly into computer systems with little or no human intervention. RFID methods utilize radio waves to accomplish this. At a simple level, RFID systems consist of three components: an RFID tag or smart label, an RFID reader, and an antenna. RFID tags contain an integrated circuit and an antenna, which are used to transmit data to the RFID reader (also called an interrogator). The reader then converts the radio waves to a more usable form of data. Information collected from the tags is then transferred through a communications interface to a host computer system, where the data can be stored in a database and analyzed at a later time.

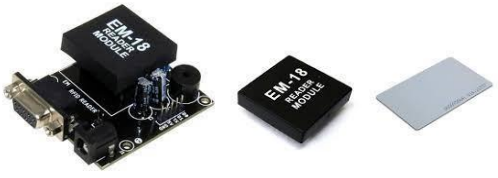

Figure 5 –RFID Module

6.5 IOT Cloud

The Node MCU (ESP8266) is a microcontroller with an inbuilt Wi-Fi module. The total pins on this device are 30 out of which 17 are GPIO (General Purpose Input/output) pins which are connected to various sensors to receive data from the sensors and send output data to the connected devices. The Node MCU has 128KB of RAM and 4MB flash memory storage

to store programs and data. The code is dumped into the Node MCU through USB and is stored in it. Whenever the Node MCU receives input data from the sensors, it crosschecks the data received and stores the received data.

6.6 Power Supply

Power supply is an electrical device which supplies electric power to an electrical load. The first function of a power supply is to convert electric current from a source to the correct voltage, current and frequency to power up the load. As a result, power supplies are also referred to as electric power converters. Some power supplies are separate standalone pieces of equipment while others are built into the load appliances that they power.

6.7 IOT (WI-FI module ESP8266)

The NodeMCU (ESP8266) is a microcontroller with an inbuilt Wi-Fi module. The total pins on this device are 30 out of which 17 are GPIO (General Purpose Input/output) pins which are connected to various sensors to receive data from the sensors and send output data to the connected devices. The NodeMCU has 128KB of RAM and 4MB flash memory storage to store programs and data. The code is dumped into the NodeMCU through USB and is stored in it. Whenever the NodeMCU receives input data from the sensors, it crosschecks the data received and stores the received data. Depending on the data received it sends a pulse to the Relay Module which in-turn acts as a switch to on or off the pump. The operating frequency of the NodeMCU ranges from 80 to 160 MHZ and the operating voltage of this device range from 3 to 3.6V. The Wi-Fi module presents in the NodeMCU range from 46 (indoors) to 92 (Outdoors) Meters.

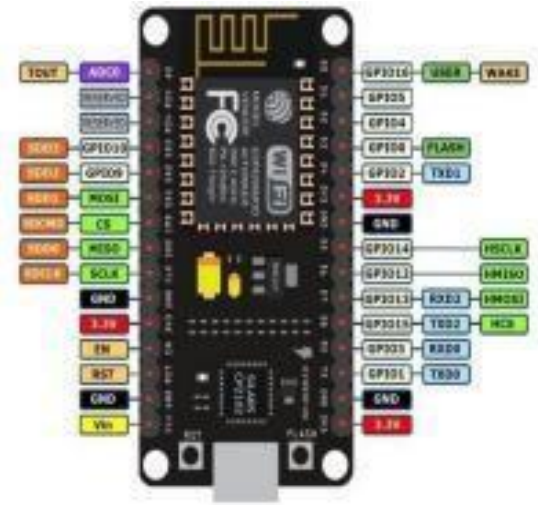

Figure 6- WI-FI module ESP8266

7.Working

7.1 Software Employed :

Arduino IDEThe arduino software (IDE) is open source software, which is used to program the Arduino boards, and is an integrated development environment, developed byarduino.cc. Allow to write and upload code to arduino boards. And it consists of many libraries.Arduino software (IDE) is compatible with different operating systems (Windows, Linux, Mac OS X), and supports the programming languages (C/C++).TheArduino software is easy to use for beginners, or advanced users. It uses to get started with electronics programming and robotics, and build interactive prototypes.So Arduino software is a tool to developed new things. And create new electronic projects, by Anyone (children, hobbyists, engineers, programmers, etc).

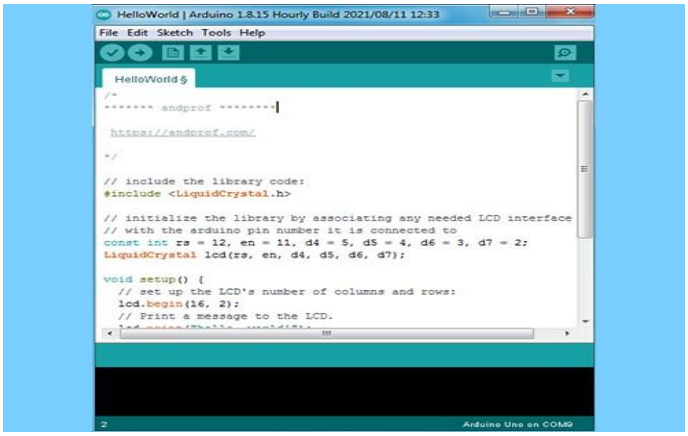

Figure 7- Arduino software interface

Menus section:Menus are the main menus of the program, and they are 5 menus (File, Edit, Sketch, Tools, Help), and they are being used to add or modify the code that you are writing.

Toolbar section:The toolbar is the most important section in the Arduino software, because it contains the tools that you will use continuously while programming the Arduino board. These tools are:

Verify: this button use to review the code, or make sure that is free from mistakes.

Upload: this button is use to upload the code on the arduino board.

New: this button use to create new project, or sketch (sketch is the file of the code).

Open: is use when you want to open the sketch from sketchbook.

Save: save the current sketch in the sketchbook. Serial monitor: showing the data which have been sent from arduino. Code editor section:

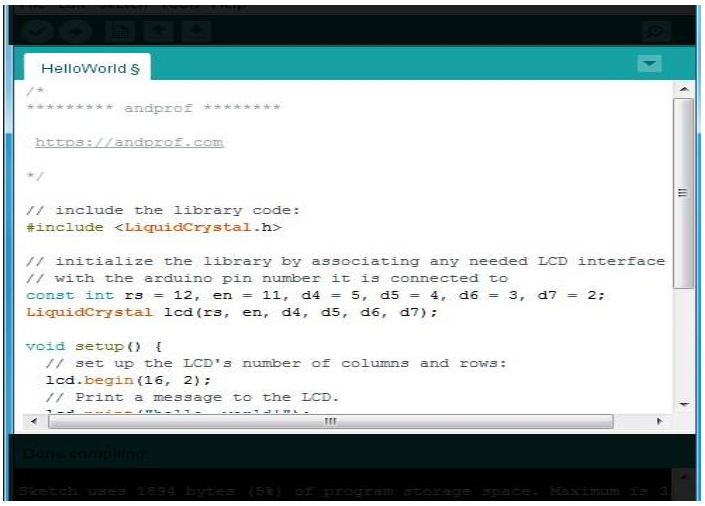

Figure 10-code editor section Code editor is liberator of codes, is the white space in the program, in which codes are been writing, and modifying on it.

Status bar section:Status bar is a space can be found down the code editor, through it showing the status of operation's completion (compiling, uploading, etc)

Program notifications section:Program notifications this program showing you the mistakes of codes, and some problems that can be face you during the programmation process. And clarifies to you the type of the mistake or the problem which happened and it reason.And it presents some instruction through it, which you have to apply to process the mistake or the problem.

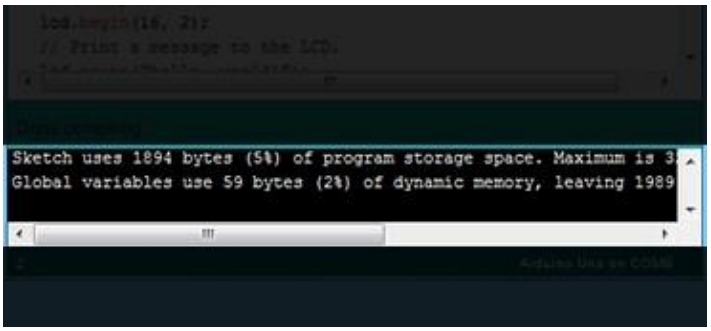

Figure 12-Program notifications section

Serial port & Board selections:Serial ports selections is a space in which the program showing you the type of the port which is used to connect the arduino by computer.

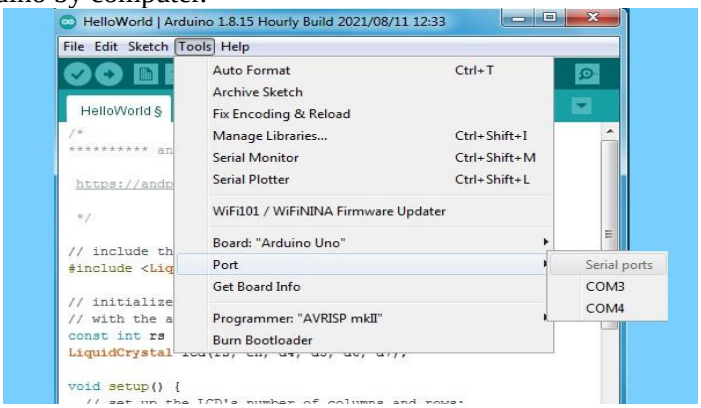

Figure 13- Serial port selection

Board selections is a space in which the program showing you the type of the arduino board.

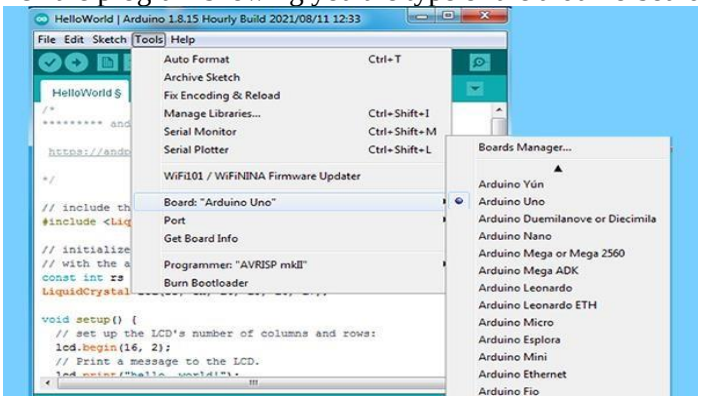

Figure 14-Board selection

7.2 Hardware Employed

NodeMCU ESP8266:The ESP8266 is, the name of a microcontroller designed by Expressive Systems. It is a self-contained Wi-Fi networking solution offering as a bridge from the existing microcontroller to Wi-Fi and is also capable of running self-contained applications. For less than $3, it can monitor and control things from anywhere in the world – perfect for just about any IOT project.

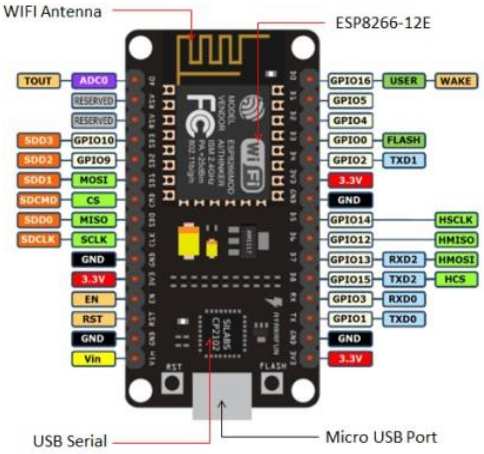

Figure 14 - Pin out

The **NodeMCU_ESP8266** has 30 pins in total out of which there are 17 GPIO pins. GPIO stands for General Purpose Input Output. There are the 9 digital pins ranging from D0D8 and there is only one analog pin A0, which is a 10 bit ADC. The D0 pin can only be used to read or write data and can't perform other options. The ESP8266 chip is enabled when the EN pin is pulled HIGH. When pulled LOW the chip works at minimum power. The board has a 2.4 GHz antenna for a long-range of network and the CP2102 is the USB to TTL converter. The development board equips the ESP-12E module containing ESP8266 chip having **Ten silica Xtensa® 32-bit LX106 RISC** microprocessor which operates at 80 to 160 MHz adjustable clock frequency and supports RTOS.There's also **128 KB RAM and 4MB of Flash memory** (for program and data storage) just enough to cope with the large strings that make up web pages, JSON/XML data, and everything we throw at IOT devices nowadays. The ESP8266 Integrates **802.11b/g/n HT40 WiFi transceiver**, so it can not only connect to a Wi-Fi network and interact with the Internet, but it can also set up a network of its own, allowing other devices to connect directly to it. This makes the ESP8266 NodeMCU even more versatile.

Power Requirement: As the operating voltage range of ESP8266 is **3V to 3.6V**, the board comes with an LDO (low dropout) voltage regulator to keep the voltage steady at 3.3V. It can reliably supply up to 600mA. It has three 3v3 pins along with 4 GND pins. The power supply is via the onboard **Microbe USB connector**. Alternatively, if you have a regulated 5V voltage source, the **VIN pin** is used to directly supply the ESP8266. Moreover, it requires 80mA Operating Current and 20 µA during Sleep Mode.

Various Peripherals and I/O: The ESP8266 supports *UART, I2C, SPI* communication protocols. It also has 4 PWM channels which can be used to drive motors, the brightness of the LED, etc. Moreover, there are 2 channels of the UART protocol. The **ADC (A0)** can be used to control any analog device. The CMD is the Chip select pin used in the SPI protocol.

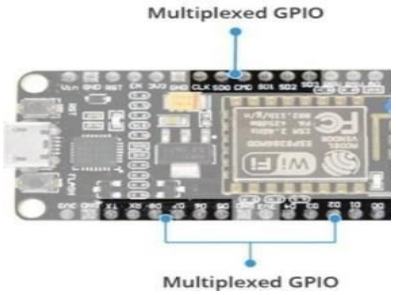

Figure 15- Peripherals & I/O

On-Board buttons and LED: ESP8266 has 2 onboard buttons along with an on-board LED which connects with the D0 PIN. The two buttons are FLASH and RST.**FLASH pin**– It is to download new programs to the board

RST pin – It is to reset the ESP8266 chip

Figure 16The LED On-board of ESP8266

Development Platforms: The prominent platforms include the Arduino IDE and the Explorer IDE. Other development platforms that can be equipped to program the ESP8266 are the Espruino – JavaScript SDK and firmware closely emulating Node.js, or Mongoose OS – An operating system for IOT devices.

8.Result

The existing disaster detection system is capable of identifying natural disasters, but lacks the capability to store data efficiently. The proposed system, however, not only detects disasters but also stores data in the cloud, allowing for quick access and analysis. By utilizing cloud storage, the proposed system ensures that critical information is not lost and can be easily retrieved by disaster response teams. This improves response times and helps save lives. Overall, the proposed system is a more efficient and effective way to manage disaster data.

9.Conclusion

In conclusion, the proposed system offers real-time monitoring which is crucial for disaster management. By using RFID technology, the system can also detect the number of people stuck in the affected areas, allowing for better response and rescue operations. This is particularly important during periods when there are drastic changes in environment conditions. Overall, the system's ability to monitor and detect changes in environment conditions and people's locations using RFID makes it a valuable tool in disaster management and can help save lives.

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