EARLY LANDSLIDE WARNING SYSTEM

Akash singh, Ayush Solanki, Ashish Barve,DR.Sunita.S. Lokhande
[234]Final Year Student, Department of E&TC, Sinhgad College of Engineering, Pune, Maharashtra.
[1]Mrs.s.s lokhande (E&TC Dept) Sinhgad college of engineering, Pune 411041

Abstract

Landslides pose significant threats to both human lives and infrastructure, especially in regions prone to geological instabilities. Timely detection of early signs of potential landslides is crucial for mitigating the risks associated with these natural disasters. This project introduces an innovative approach utilizing the NodeMCU platform, integrated with a suite of sensors including accelerometers, gyroscopes, and moisture detectors, to create an early landslide detection system. By continuously monitoring ground conditions, including soil moisture levels and ground vibrations, the system employs real-time data analysis and anomaly detection algorithms to provide early warnings to relevant authorities and communities. The implementation leverages the versatility and connectivity capabilities of C, ensuring seamless data transmission for remote monitoring and rapid response. This project not only showcases the potential of IoT technology in enhancing natural disaster preparedness but also underscores its significance in safeguarding lives and property. The experimental results and performance evaluation demonstrate the effectiveness of the proposed system in detecting early signs of landslides, offering a promising solution for proactive risk management in landslide-prone areas.

Keywords: Embedded based,NodeMCU

*INTRODUCTION

Landslides, often triggered by geological and environmental factors, can have devastating consequences on communities and infrastructure. Detecting early warning signs of potential landslides is paramount for minimizing risks and ensuring timely interventions. This project introduces an innovative system that leverages the NodeMCU platform, integrated with an array of sensors, to create an early landslide detection system. By continuously monitoring ground conditions and employing real-time data analysis, the system provides early warnings to mitigate potential disasters. This project not only showcases the potential of IoT technology in enhancing natural disaster preparedness but also emphasizes its crucial role in safeguarding lives and property. Through rigorous experimentation and evaluation, the effectiveness of this system in detecting early signs of landslides is demonstrated, offering a proactive approach to risk management in landslide-prone areas.

*LITERATURE SURVEY

Many researchers have worked on the landslide detection system based on Internet of Things using development boards like Arduino and and Raspberry pi mostly. Maneesha V. Ramesh of Department of Computer Science, Amrita School of Engineering, Amrita Vishwa Vidyapeetham (AMRITA University), Kollam, Kerala, India published paper on “Real-time Wireless Sensor Network for Landslide Detection” published in 2009 Third International Conference on Sensor Technologies and Applications. They have used pore pressure transducers, soil moisture sensors, geophones, stain gauges and tiltmeters connected via the wireless system network. Their main aim was to detect the landslides that are caused due to the heavy rainfall.

The collected data is transfer with the help of WIFI network to the FMC that uses external antenna and access point. They have used the VSAT satellite for the communication to the database server at Amrita University's Amritapuri campus. They have shown in their paper that during 2008 monsoon the sensors were able to receive the data in heavy rainfall of the soil. Their system is efficient in analyzing the real time data over the internet about the landslide. Advancements in BMS aim to enhance efficiency, reliability, and integration with emerging technologies.

***OBJECTIVES**

1. Design and integrate a comprehensive suite of sensors, including accelerometers, gyroscopes, and moisture detectors, to continuously monitor ground conditions.

2. Develop and implement advanced anomaly detection algorithms to swiftly identify potential landslide risks based on sensor data.

3. Utilize the NodeMCU platform for seamless integration, data processing, and connectivity capabilities.

4. Enable remote monitoring and rapid response functionalities to enhance disaster preparedness and response.

➢ TOOLS AND TECHNOLOGIES

***HARDWARE COMPONENTS**

3.3.1. NodeMCU

- NodeMCU is an open-source IoT platform based on the ESP8266 WiFi module.
- It integrates a microcontroller unit (MCU) and WiFi capabilities, making it suitable for IoT applications.

3.3.2. Temperature and Humidity Sensor

- A temperature and humidity sensor, also known as a hygrometer, is a device designed to measure both temperature and relative humidity in its environment.
- It combines the capabilities of a temperature sensor and a humidity sensor into a single integrated unit.

3.3.2. Moisture Sensor

- A moisture sensor, also known as a soil moisture sensor or hygrometer, is a device designed to measure the moisture content in soil or other porous materials.
- It operates on the principle that the electrical conductivity or capacitance of the material changes with variations in moisture levels.

*METHODOLOGY

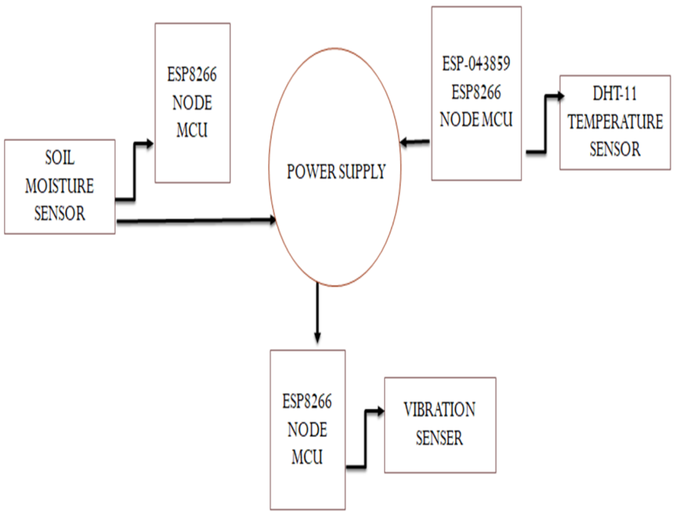
A. Sensor Detection:
This system uses soil moisture, accelerometer and vibrational sensors .Moisture sensor readings are indicative of the moisture content in the soil whereas accelerometer checks movement of land.Vibration sensor will detect even the small vibration in land. The variation in reading crossing the previously defined thresholds alarms the local citizens to safeguard themselves.

B. Comparison of Detected Values:
Firstly, the soil moisture sensor reading is accepted and it is compared with the threshold values that are already programmed. There are totally 256 (0-255) levels and values are mapped in between them. If the detected reading is in between the range of (160 to 255), it displays the message in LCD display as "Soil Moisture = SAFE range" over MQTT under soil moisture topic. If the detected reading lies in between (130 to 160), it displays the message in LCD display as "Soil Moisture = MIDDLE range" and if reading lies below 130, it displays the message in LCD display as "Soil Moisture = DANGER range". After soil moisture status; readings of accelerometer are considered. Similarly the vibration sensor values are also considered. Finally, the average of all the sensor readings is calculated and the result is saved as "Reference". All the values next are then compared with this reference value. Then the new received value
and the reference value are subtracted from each other and the result obtained will directly represents the vibration intensities sensed in the ground.

C. Configuration of Microcontroller:
The part of microcontroller (NodeMCU) comes into picture when the system is powered up, then the Node MCU configures and actually to Wi-Fi and the MQTT server. Then, it starts accepting readings from soil moisture, accelerometer and vibration sensors. First, it accepts the soil moisture sensor reading and compares it with the programmed threshold values. The moisture sensor outputs analog voltage proportional to the moisture content in the soil.

D. Uploading of Data:
All the sensor data are collected and processed. These data are logged to a web channel on Thing Speak platform through a wireless network to which the microcontroller is connected. The message protocol used here is MQTT protocol. The data are compared with a maximum threshold set. If there's a fluctuation or sudden changes, the same is notified on the mobile application/web application. "Thing Speak" is used as the IoT platform (cloud storage).

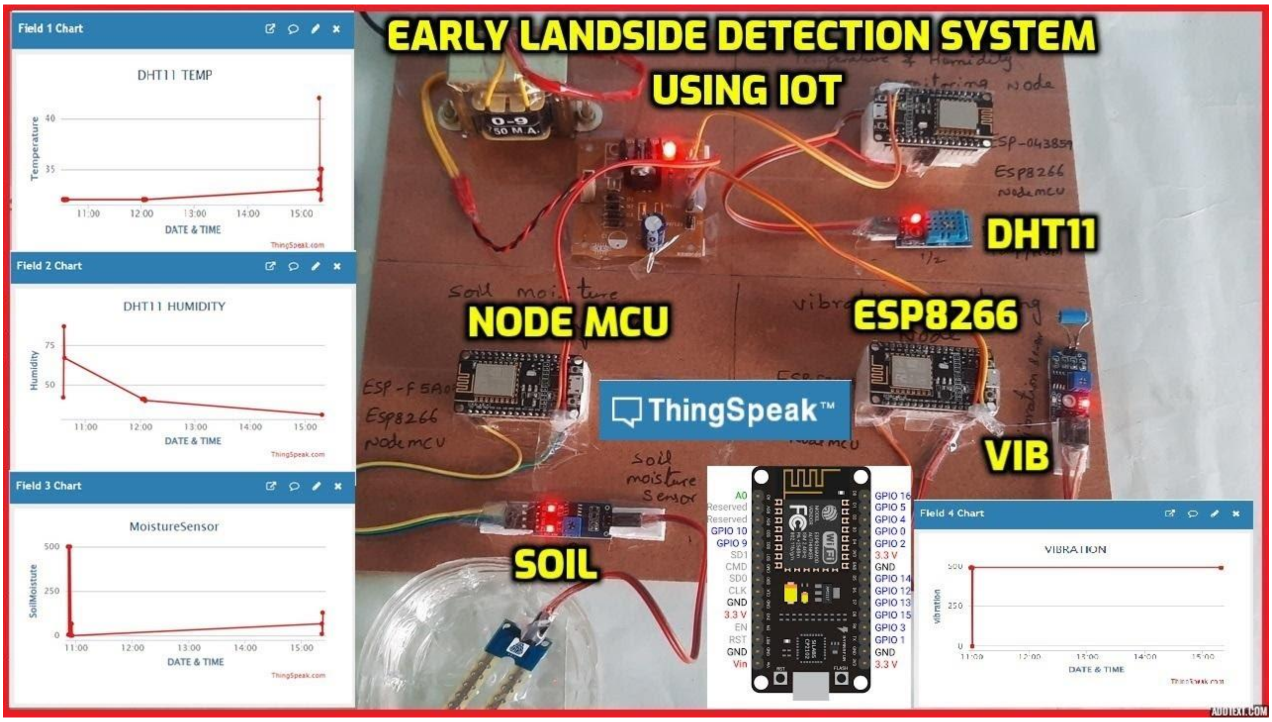
F. System Overview:
The flow diagram below is the quick overview of the system.



ADVANTAGES:

• UWB signals are mostly not distinguishable from background noise for other radio receiver because of restriction of transceiver power
• UWB systems do not need a carrier frequency
• The installation and the hardware are easier and cheaper compared to systems with a carrier frequency
• Less power requirement compared to other systems with a carrier frequency (for example WLAN)
• No direct view is needed.

RESULT:



CONCLUSION:

This project provides a substantial contribution to the development of methods and technologies for early warnings with regard to mass movement events. Its interdisciplinary constitution offers the possibility to process the complex problem of effective early warning by classifying multiple approaches. Highly complex events like slopes failures depend on multiple sensitive parameters (e.g. humidity and stress constitution in an endangered area). The combination of small and precise measuring sensors like tiltmeter or displacement transducers, used in automobile technology, with a self-organizing monitoring system in a network permits the advance of a real-time monitoring system that is suitable for the detection and the observation of mass -12- movements. Modern sensor networks, like ad hoc wireless sensor networks have the advantage over currently existing landslide monitoring systems that they can be used very variable and the installation is quite simple. Furthermore the short-distance communication between adjacent nodes (still up to 1 km free space communication distance) allows cutting down costs and administrative effort. In addition, as the nodes are directly connected with each other, local preprocessing of the data can be applied and sensor fusion.

➢ REFERENCES

- Title: Toward a real-time service for landslide detection: Augmented explicit semantic analysis and clustering .
- Authors: A. Musaev, D. Wang, S. Shridhar, C.-A. Lai, and C. Pu,
- Published in composition approaches," in Web Services (ICWS),2015 IEEE International Conference on. IEEE, 2015, pp. 511–518.
- Title: "Wireless sensor networks for condition monitoring in
- the railway industry: A survey,"

  Authors: V. J. Hodge, S. O'Keefe, M. Weeks, and A. Moulds
- Published in: A survey," IEEE Transactions on Intel- ligent Transportation Systems, vol. 16, no. 3, pp.
  1088–1106, 2015.
- Title: Landslide Monitoring System with GSM Module.
- Authors: A.Dinagar, P.Karthick, K.Karthi, P.Tamilvanan, S.Premkumar
- Published in: International Journal of Innovative Research in Computer and Communication Engineering, Vol. 3, Special Issue 2, March 2015

.