AUTOMATING THE DETECTION OF LANDSLIDES IN DUAL MODE TECHNIQUE

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Abstract—Landslides are a huge socioeconomic danger to regions that are geographically favoured. Existing landslide monitoring methods and strategies have major technical (quality and data frequency) and usability limitations (high inferred costs, very high expertise requirement). We are developing a ground-breaking system for tracking landslides in this project, which makes use of cutting-edge IoT technology. To track landslides, the system comprises of a succession of autonomous sensing devices fitted with a specially customized sensor suit. The devices capture sensory measurements at regular intervals while operating at a very low duty cycle and send them to a data server powered by a cloud server for duration and display through the LoRa network. The system is based on a scalable, modular architecture that has shown to be very dependable. As a consequence, plans are in the works to expand its use to other places.
Keywords: Landslides, IoT, LoRa

I.INTRODUCTION

In India, landslides are most common during the monsoon season, resulting in significant loss of life and property. Highways, trains, and pipelines are all severely damaged. They usually occur in conjunction with other severe natural catastrophes such as earthquakes, volcanic eruptions, and floods induced by excessive rain. Expanded development and human activities, such as altered land slopes and deforestation, can increase the incidence of landslides in many circumstances. An early warning system for landslide prediction might greatly decrease these losses. We want to deploy wireless sensor networks in landslides occurring. Wireless sensors are one of the most advanced technologies, able to respond fast to fast changes in data and communicate the data to a data monitoring centre through LoRa. Sensors are simple to install and offer real-time data on landslide activity. They can be placed immediately on the landslide body or in the surrounding area. A landslide is a natural calamity that occurs regularly in steep areas. The Himalayas, Indo-Burmese Range, Western and Eastern, Nilgiris, and Vindhya Range are all major landslide-prone locations in India. It impacts over 15% of India's land area, or almost 0.5 million square kilometers.

The internet of Things (IoT) is a term for the communications that uses new information and communication technologies in an Internet-like structure to allow sophisticated, ubiquitous services between interconnected physical and virtual things [1]. Things in the Internet of Things are objects with sensors and the ability to correspond, consequences in networks that enable new and ground-breaking business models and processes while dropping the expenses and risks associated with traditional ones [2]. The cyber-physical union that is at the heart of broader prototype shifts like Industry 4.0 [3] and the spherical market [4] is enabled by the IoT's techno-social environment. The financial impact of IoT is also massive; by 2025, more than 55 billion IoT devices will be organized worldwide, with around 15 USD billions spent in IoT between 2017 and 2025 [5]. Investment areas already span health care, security, transportation, dangerous infrastructure, manufacturing, and other economic sectors and use-case verticals [6]. The benefits of IoT, on the other hand, include the capacity to allow new innovative services that were previously inaccessible, in addition to cutting prices and rising the efficiency of present schemes.

The development of Single Board Computers [7] has considerably decreased the CapEx of creating and deploying IoT systems while also increasing their adaptability. Another key impact has been advancements in wireless communication technology. Low-power personal area network (LowPAN) protocols like IEEE802.15.4 and Bluetooth Low Energy (BLE) at the physical and MAC layers, and 6LoWPAN and 6TiSCH at the networking levels, have allowed IoT structures in interior situations such smart building [8] and factories [9], [10]. Wireless wide area networks for the Internet of Things, such as LoRaWAN [11], SigFox [12], and NB-IoT [13], on the other hand, enable the deployment of IoT systems over large geographic areas, allowing for novel business models and decision-making mechanisms for private companies as well as local and national governments.

II. OBJECTIVES

The project's purpose is to develop an architecture that will allow data and semantic interoperability between non-public ICT and the Internet of Things for Landslides. This will allow heterogeneous components from many domains to communicate and deploy in Landslide disaster recovery operations without requiring considerable system research and configuration.

- To monitor the landslides using appropriate sensors and micro controllers and detect live human in disaster detected area.
- To reduce vulnerability and to minimize the loss caused by landslide through better planning process.
- To use LoRa that is long range it has dual mode technique
- LoRa module can transmit data up to 15km of range and hence is very useful than other wireless medium.

III. EXISTING SYSTEM

A vital part of every significant civil engineering project is the measuring and recording of data relating to the physical features of the earth's surface. The knowledge that these terrain assessments give is crucial in the early phases of a project's design. Different sorts of equipments and procedures can be used to monitor structural deformation and ground surface displacements during landslides.
These techniques and tools can be classified into the following categories:

1. satellite or remote sensing methods
2. Basic methods for photogrammetry
3. Observational or geodetic approaches and
4. Geotechnical, instrumentation, and physical techniques are all examples of geotechnical techniques.

IV. METHODOLOGY

We have Lo-Ra modules for away correspondence and sensors for information retrieval in the suggested system. Soil moisture sensor, humidity sensor, rain gauge sensor, and accelerometer sensor are among the sensors used. When the sensor values exceed the threshold value, a warning system will be activated at a distant location.
The information collecting and monitoring unit collects data using various sensors and controls it using a microcontroller. As a result of the information being communicated from the collection and control section, it becomes a transmitting unit. We have a variety of sensors in this device, including a soil moisture sensor, a humidity sensor, a rain gauge, and an accelerometer sensor.

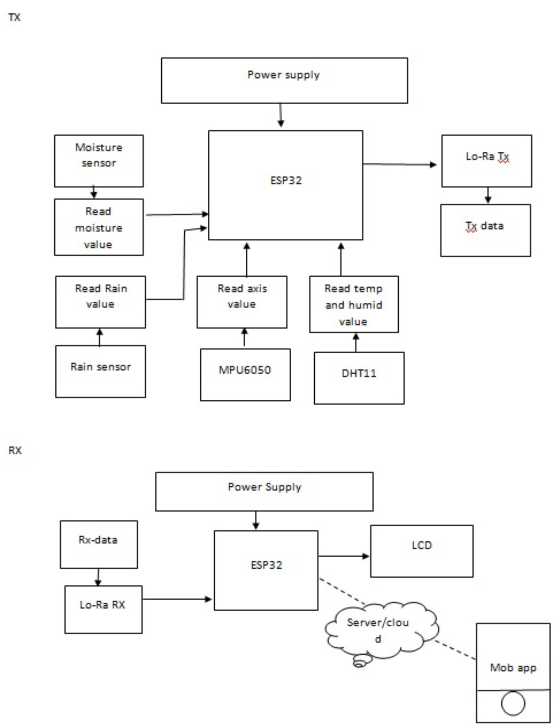
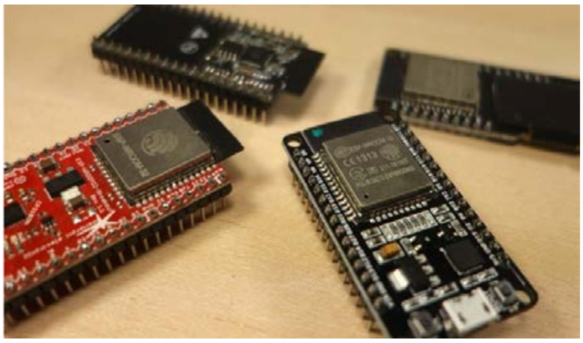


FIG 1: BLOCK DIAGRAM

Power supply, soil moisture sensor, temperature and humidity sensor, rain gauge sensor, accelerometer sensor, and LoRa module blocks make up the transmitter circuit. The sensors are linked to the microcontroller's MPU6050 and ESP8266 . For sensors to adequate output, the signal conditioning circuit is needed. Because the data from the sensors is in voltage form, we must convert it to a usable format before displaying the findings.
The power supply is set at 3.3 volts for the microcontroller and 5 volts for the peripheral modules. LoRa is used to send and receive data.

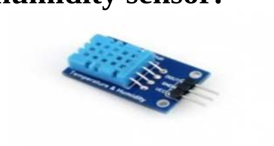
1. Tilt-meter: A device that measures the movement of soil in terms of creep, slow or rapid movement.
2. Rain gauge: Measures the impact of rain on a slope and, as a result, auxiliary effects such pore pressure.
3. Temperature Sensor: It changes the physical qualities of soil and water, which are recorded every second.
4. Dielectric Moisture Sensors: The soil's water content is measured.

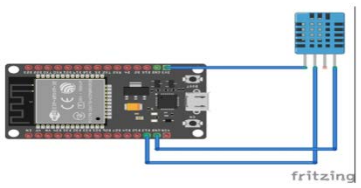
MICROCONTROLLER:



A microcontroller (MCU stands for microcontroller unit) is a tiny computer that is made up of a single MOS integrated circuit chip. It's similar to, but less complicated than, a system on a chip (SoC), which may contain a microcontroller among its elements.

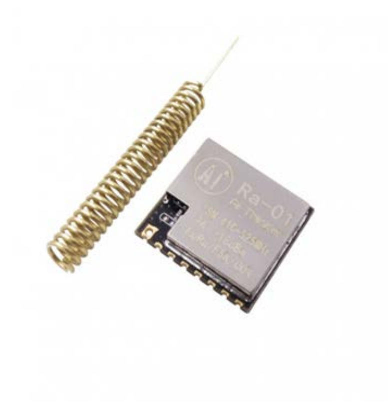
Temperature and humidity sensor:





The DHT11 is a compound sensor with a adjusted digital temperature and humidity signal output. The product's high dependability and long-term stability are ensured by temperature and humidity sensor technology, as well as specialized digital module collecting technology.

Lo-Ra:



LoRa may be utilized for ultra-long-distance spread spectrum communication, as well as suitable FSK remote modulation and demodulation, to address the classic wireless blueprint flaws of distance, anti-interference, and power utilization. Ra-02 is a versatile networking device that may be used for automatic meter sensing, home building mechanization, security methods, and remote irrigation schemes. It is the appropriate answer for items association applications.

FEATURES

- LoRa ™ spread spectrum modulation technology
- Receive sensitivity as low as -141 dBm
- Outstanding resistance to blocking
- Supports preamble recognition
- Supports half-duplex SPI statement
- Programmable bit rate up to 300Kbps
- Supports FSK, GFSK, MSK, GMSK, LoRa ™ and OOK modulation modes
- Supports automatic RF signal detection, CAD mode and ultra-high speed AFC
- Package with CRC, up to 256 bytes – Small package with double volume squashs

SOIL MOISTURE SENSOR:

Soil moisture sensors obliquely measure the volumetric water content by using another property of the soil as a proxy for the moisture contant, or neutron interaction, because direct gravimetric measurement of free soil moisture demands the deletion, drying, and weighing of a model.

MPU6050:

The MPU6050 has a 3-axis MEMS gyroscope and a 3-axis MEMS accelerometer. When it comes to motion detection, it's quite useful. This little module combines the logic level converter circuit (which allows it to work with voltage levels ranging from 3.3V to 5V) with the MPU6050 sensor, making it simple to integrate.

V. SYSTEM ARCHITECTURE

CLIENT NODE:

In Fig 1 we have shown the data flow diagram on client node. Here, firstly the sensors are initialized and they are connected to the base station so that the infromation is display and sent to the authority. All the sensors sences the information and send it to the microcrntroller. Further, microcontroller is connected to the LoRa transmitter will send the data to the base station where the LoRa receiver is present.

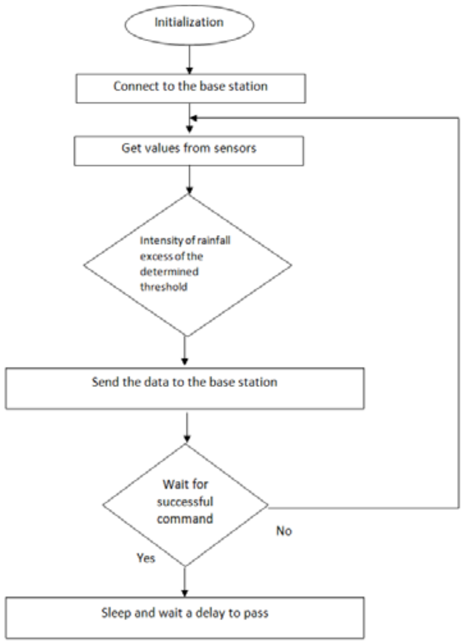


FIG 2: DATA FLOW ON CLIENT NODE

BASE STATION:

In Fig 2 we have shown the data flow diagram on Base Station. Here whatever the values that are transmitted from the Client Node are received by the LoRa receiver and by this receiver we diplay the values on the LCD screen present in the Base Station. If there is network in the Base Station then the values can be viewed in the mobile phone and if there is raise in the values we will get the alert message with buzz sound.

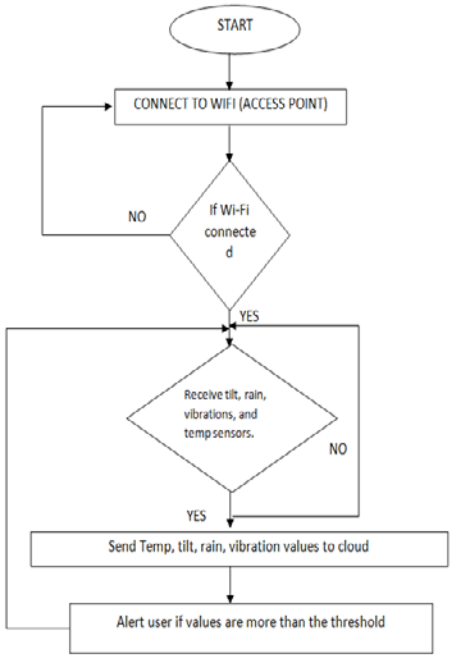


FIG 3: DATA FLOW ON BASE STSTION

VI. SCREEN SHOTS

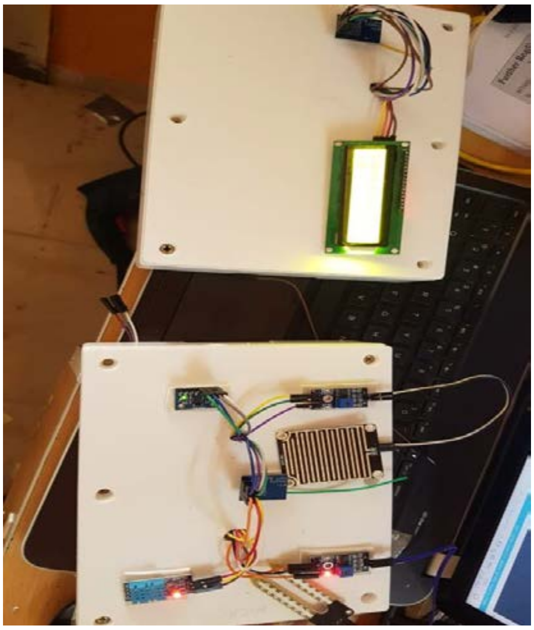


FIG 4: TRANSMITTER AND RECEIVER STATIONS

FIG 5: BASE STATION

FIG 6: LCD SCREEN

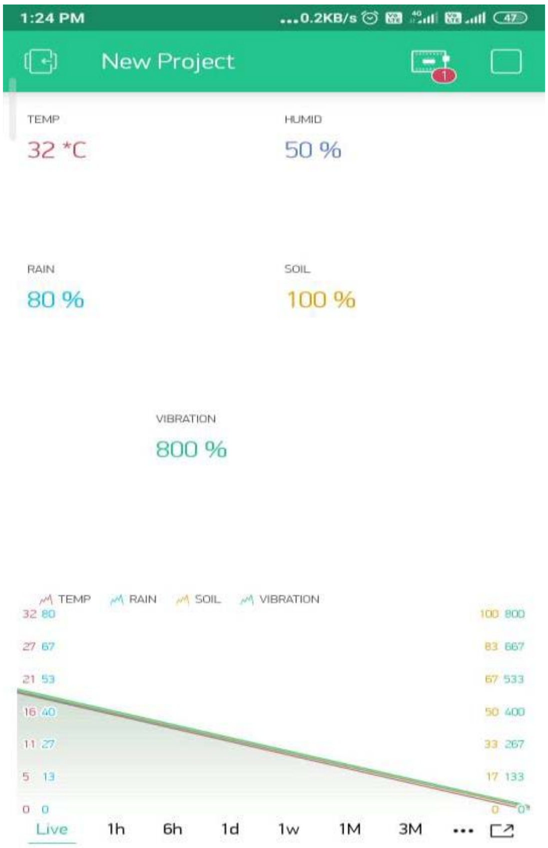


FIG 7: VALUES IN BLYNK APP

FIG 8: VALUES & GRAPH IN BLYNK

V. TESTING

Software testing is an inquiry conducted to provide stakeholders with information about the quality of the product or service being tested. Program testing may also provide a company with an objective, unbiased view of the program, helping them to understand and appreciate the risks involved in program deployment. The process of executing a programme or application with the goal of identifying software faults is known as testing (errors or other defects). Software testing is the process of evaluating one or more qualities of interest by executing a software component or system component.

VI. CONCLUSION

Landslides represent a substantial socio-economic danger to places that are geographically favoured. Current landslide tracking methods and techniques have significant inadequacies in terms of both technology (data quality and frequency) and application (high implied costs, unique skill requirement). We presented a ground-breaking landslide detection framework based on cutting-edge IoT technologies in this study. The software is highly robust and adaptable, despite the fact that its deployment and service are far less expensive than existing options.

The technology has been successfully installed, giving a contemporary approach to swiftly control a landslide site. When a major change occurs in the globe, we can learn more about the specifics sooner thanks to LoRa and IoT technology.

VII. REFERENCES

1. "The Internet Of Things: A Servey," By L.Atzori, A.Iera, And G.Morabito, Computer Networks, 2010.
2. "The Internet Of Things," By M.Chi, M.Loffler, And R.Roberts, 2010.
3. "Industry 4.0," By H.Lasi, P.Fetteke,H-G. Kemper, T.Feld And M. Hoffmann, Business And Information System Engineering ,2014.
4. "A Review On Circular Economy :The Expected Transition To A Balanced Inter Play Of Environmental And Economic System," By P.Ghisllini, C.Cialani, And S.Ulgiati, 2016.
5. "Size Of The Internet Of Things Market World Wide In 2014 And 2020,By Industry," By Statista ,2018.
6. "Wirless Sensor Networks: A Survey," By I.F.Akyildiz, W.Su, Y.Sankarasubramaniam, And E.Cayirci,2002.
7. "Performance Analysis Of Latency Aware Data Management In Industrial Iot Networks." By T.Raptis, A.Passarella And M.Conti,2018.
8. "Sigfox System Description," By J.C.Zuniga And B.Ponsard,2016.
9. "Landslides:Investigation And Mitigation," A.K.Turner And G.Jaya Prakash,1996.
10. "Terrestrial Laser Scanning And Digital Phto Grammetry Techniques To Monitor Landslide Bodies," By G.Bitelli, M.Dubbini, And A.Zanutta,2014.
11. "Nb-Iot System For M2m Communication," By R.Ratasuk,B.Vejlgaard ,N.Mangalvedhe And A.Ghosh,2016.
12. "Maximizing Industrial Iot Network Life Time Under Latency Constraints Through Eadge Data Distribution," T.P.Raptis,A.Passarella And M.Conti b, 2016.
13. "Applilability Of Commodity , Low Cost, Single Board Computers For Internet Of Things Devices",By S.J Johston,M.A Petroaie-Cristea,M.Cott And S.J.Cox In 2016 IEEE 3rd Forum On Internet Of Things, 2016.
14. "A User-Enabled Test Bed Architectuture With Mobile Crowdsensing Support For Smart , Green Buildings ," By C.M.Angelopouls, O. Evangelatos, S.Nikoletseas , T.P.Raptis , J.D.Rolism, And K.Veroutis, 2015.
15. "Understanding The Limits Of Lorawan," By F.Adelanted, X .Vilajosona,P.Tusetpeiro,B.Martinez,J.Meliasegui, And T.Wattezne,2017.