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Restoring transportation system in hilly areas during peak rainy season

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Abstract
Landslide detection system using the Wireless Sensor Network based on the IoT "Internet of things". After the landslide Detection System, for restoring transportation we are going to designed movable bridge. Thus, this project is very important as we use it in our real time purpose for saving lives and property.

Keywords: *Nodemcu, Vibration sensor, Temperature and Humidity sensor, Soil moisture sensor, L298 Motor driver, Arduino uno, IR sensor, Landslide detection system, Movable bridge.*

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I. INTRODUCTION

In hilly areas during monsoon season the road connectivity is a major problem. Due to heavy rainfall, complete washout of roads takes place up to 50 m length, landslide in many locations disturbs the flow of traffic, natural calamity and extreme weather incidents is a matter of concern. Restoring of connectivity in the shortest possible duration is required so that small vehicles and regular traffic flow can be resumed. In order to reduce and prevent the damage of landslides, landslide monitoring is very important to the prediction and estimation of the landslide hazard and prevention. During the rainy season, unlike hilly areas are affected by the landslide natural hazard every year. Landslide detection system using wireless sensor network based on IOT. The landslide causes rock falls, debris falls and flows blocking the road for communication. For restoring transportations, we are going to design movable bridge.

1.1.1 Literature Review

In 2015, Y. Lami, D. Geno, Catalot, Fourty, A. Lagreze published a paper titled Wireless sensor network for Landslide prevention and enabled long range communication using very low power levels. This paper describes the evolution of a wireless sensor network system for landslide detection in the particular area and the development of a wireless sensor networks to detect landslides, which includes design and development of network for real time monitoring system. In 2016, YongWan, Zhipu, Liu, DianhongWang published a paper named Anomaly detection and visual perception for landslide monitoring based on a heterogeneous sensor network and innovated an architecture of an innovative landslide monitoring system based on double layer and heterogeneous sensor networks. In 2014, Jagat K. Shresthaa, Agostinho Bentab, Rui B. Lopesc, Nuno Lope, the rural road network upgrading problem, using a multi-objective optimization model, to support decision-makers in the choice of roads to upgrade in the hilly regions. The model considers two objectives: minimization of user operation costs and maximization of population covered. The problem was solved for a real-world rural road network, all non-dominated solutions were obtained and the ones providing more interesting trade-offs were analysed. The model was found suitable for the case under study, and possibly, easily extendable to rural areas of other developing countries.

1.2 Problem definition

The occurrence of landslides on hill roads is quite common. The landslides are associated with rock falls, debris falls and flows blocking the road for communication. Land subsidence and blocking of natural streams caused by soil erosion and debris flow are also sometimes seen. Many times, a portion of the road slides along with the landslide. Landslides, due to the floods, damaged several houses and structures, killing those who were trapped. So, Due to loss of Lives in Landslide their need to develop a system which predicts its occurrence and alert the Authority to take preventive measures. Restoration of traffic in these areas not only takes a lot of time and money but also causes great inconvenience to the road users. The landslides also cause huge loss of property and lives to the inhabitants of nearby villages. The major problem is the occurrence of landslide on

hilly road, wherein the only solution is through providing temporary bridges so that the vehicle can move and it should be a safe.

1.2.1 Need and Scope of the Project

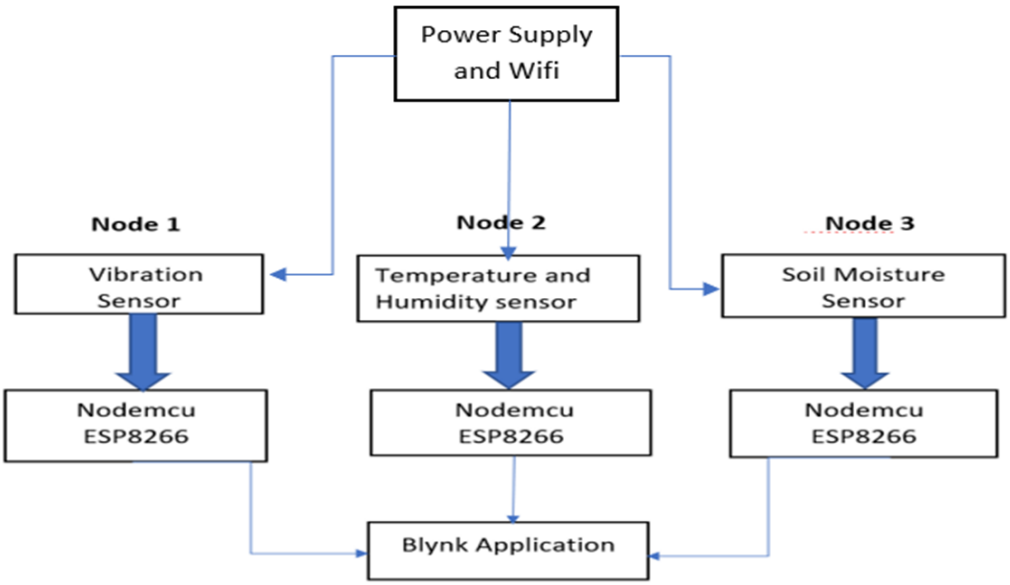
The main aim of implementing this project is to save human life and their property. Development of an affordable landslide detection and monitoring system using a cell phone application designed in Blynk based on the Wireless Sensor Network using IOT support devices like Nodemcu ESP8266. Though there exist systems for monitoring landslides there is an urgent need for improving the same for better monitoring of the landslide-prone areas and early warning dissemination. This landslide detection system aims for the Development of an affordable landslide monitoring system using based on the Wireless Sensor Network for efficient data collection of landslide precursor signals. The project deals with the study and application in restoration of hill transport. Hill roads are normally in bedraggled condition due to heavy rain and improper maintenance for several years. An efficient hill transport system is a prerequisite for sustained development. The only solution is through providing bridges so that the vehicles can move and to avoid accident. It should be a safe, durable and low-cost solution

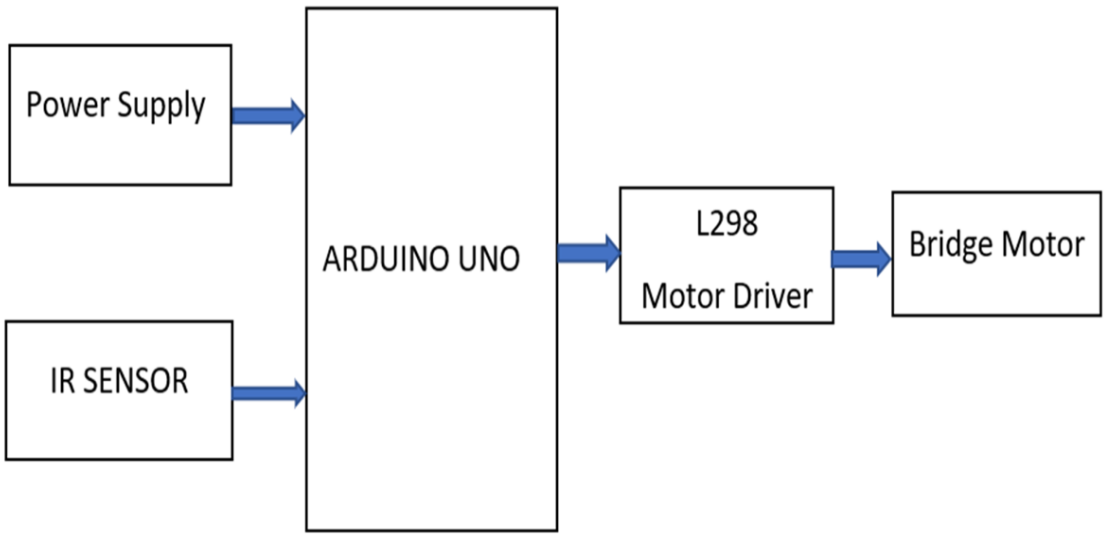
1.3 Design Methodology

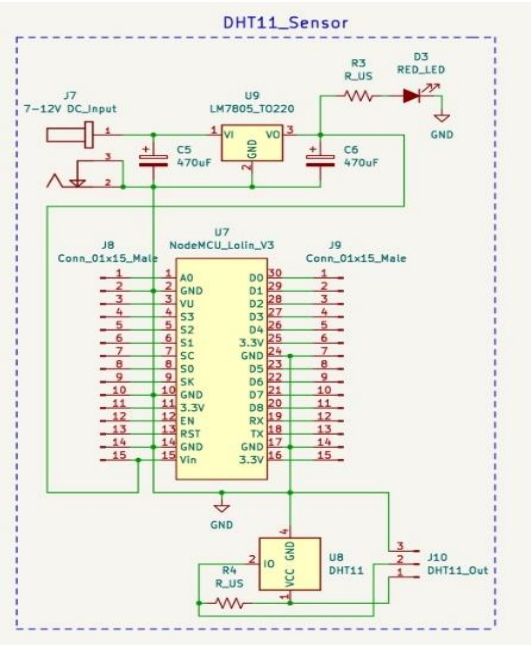
1.3.1 System Design

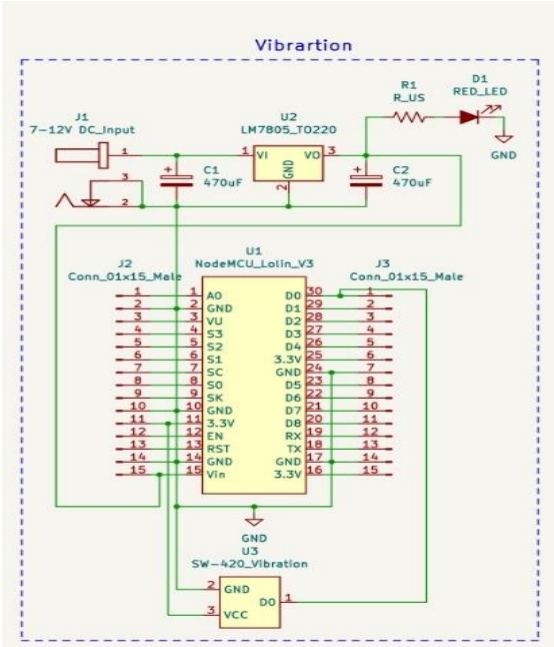
In this System there are two parts, first is Landslide Detection System and second is Movable Bridge. First system we designed to detect the landslide In landslide detection system there are three nodes, Node 1 is Vibration sensor with Nodemcu, Node 2 is Temperature and Humidity Sensor with Nodemcu, Node 3 is Soil Moisture Sensor with Nodemcu. Landslide Detection System Node 1: In node 1 a vibration Sensor "SW-420" is connected with the Nodemcu ESP8266 Wi-Fi module. This Node is responsible for monitoring the vibrations. The vibration data is sent after every 1 second to the Blynk application. When the vibration exceeds a predefined value an "Vibration Detected" alert is generated. Landslide Detection System Node 2: In node 2 the DHT11 temperature and humidity sensor is connected with the Nodemcu ESP8266 Wi-Fi module. This Node is responsible for monitoring the temperature and humidity. The temperature and humidity data is sent after every 1 second to the Blynk application where the data is displayed on the Temperature gauge and Humidity gauge. Landslide Detection System Node 3: In node 3 a soil moisture sensor is connected with the Nodemcu ESP8266 Wi-Fi module. This Node is responsible for monitoring the soil moisture. The soil moisture data is sent after every 1 second to the Blynk application. When the soil moisture exceeds a predefined value an" Soil Moisture increased!!!" alert is generated. The soil moisture is also monitored in real-time, this way precaution steps can be taken in advance. Vibration sensor, Temperature and Humidity sensor, Soil Moisture sensor, all these sensors are connected with different IOT node which make complete network. When alert is generated through this system or network, it will send Notification to Blynk application and also send email through Blynk application to Email Id, that the alert is generated, then this network is able to informed the prerequisite of landslide detection to the respective Department. In second system We Design Movable bridge for restoring transportation. to avoid any accidents and traffic, providing solution to this is temporary movable bridge. In this system IR sensor is connected to Arduino Uno. When sensor sense the vehicle is coming towards the bridge it sends data to arduino and then that data is process to arduino to L298 motor driver it will start the motor and then bridge is open to passed the vehicle through it. after that if there is no more movement or no more vehicle is coming towards the bridge then after delay time bridge will be automatically close. This System is used to designed for avoiding accidents, to avoid traffic jam, this will not suffer to people who is coming through this root.

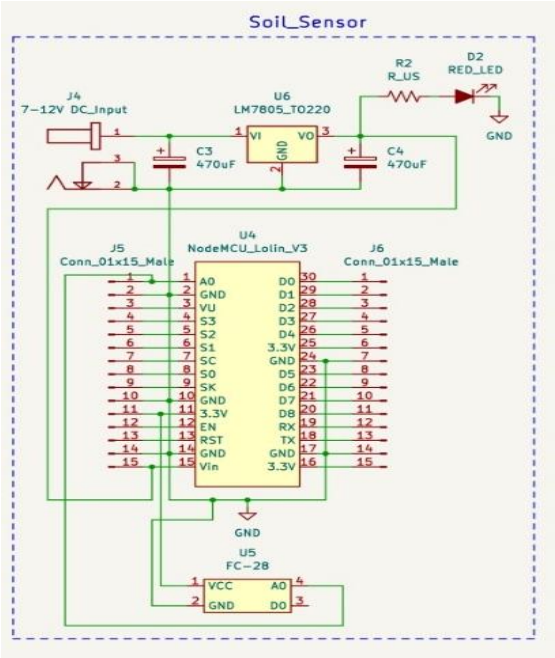
1.3.2 Block diagram and Circuit diagram











1.3.3 Components

For Landslide detection system: -

1. Nodemcu ESP8266 Wi-Fi Module
2. SW-420 Vibration Sensor
3. DHT-11 Temperature and Humidity Sensor
4. FC-28 Soil Moisture Sensor
5. 470 uf capacitor
6. DC Female Power Jack
7. Female Header
8. Male Header
9. LED
10. 330-ohm Resistor
11. LM7805 Voltage Capacitor
12. Batteries

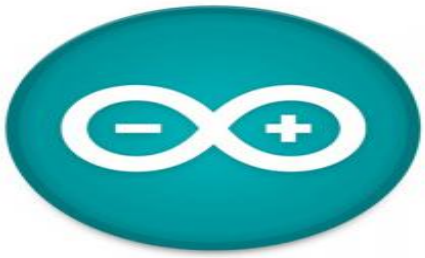
For Movable Bridge: -
1. Arduino Uno
2. L298D Motor Driver
3. IR Sensor
4. CD Tray
5. Battery

1.3.4 System Working

When system starts, If WIFI is connected to system then it will read vibrations, Temperature Humidity, Moisture of soil from the sensor If WIFI is not connected then, it will show device is offline in blynk application. If readings of all sensors exceed the predefined range it will generate the alert in blynk app and send notification and mail to department. Else it will send continuous data to the blynk application. When alert generated and landslide occur then it gives notification to department then department will send bridge on that place to restore the transportation the bridge sensor senses the movement, if movement is not detected it will return to the initial process, if movement is detected then the bridge will be open and after delay time is over it will automatically close.

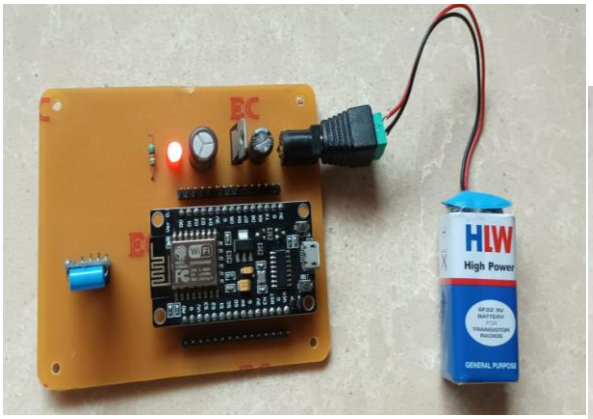
1.3.5 Software Implementation

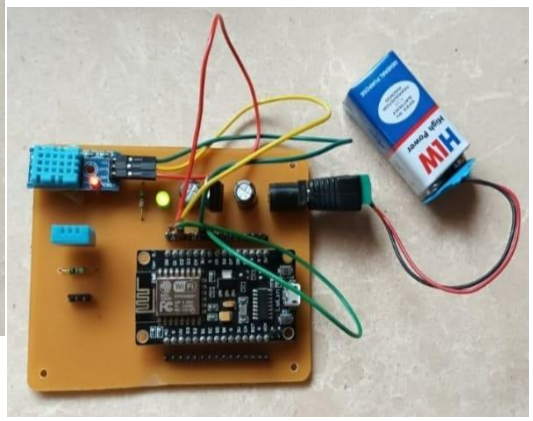
The Arduino Integrated Development Environment (IDE).
It is used for writing code, compiling the code to check if any errors are there and uploading the code to the Arduino and nodemcu.

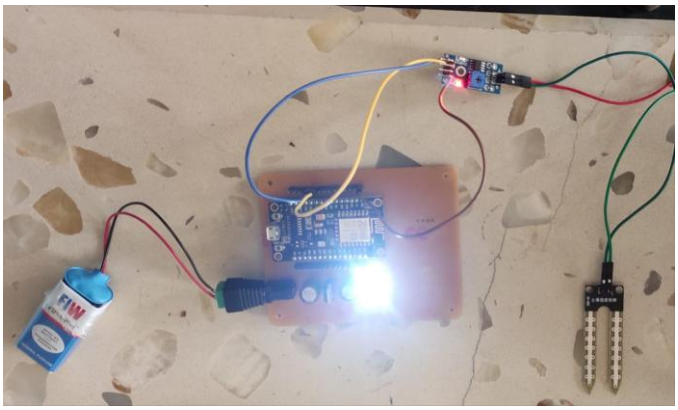


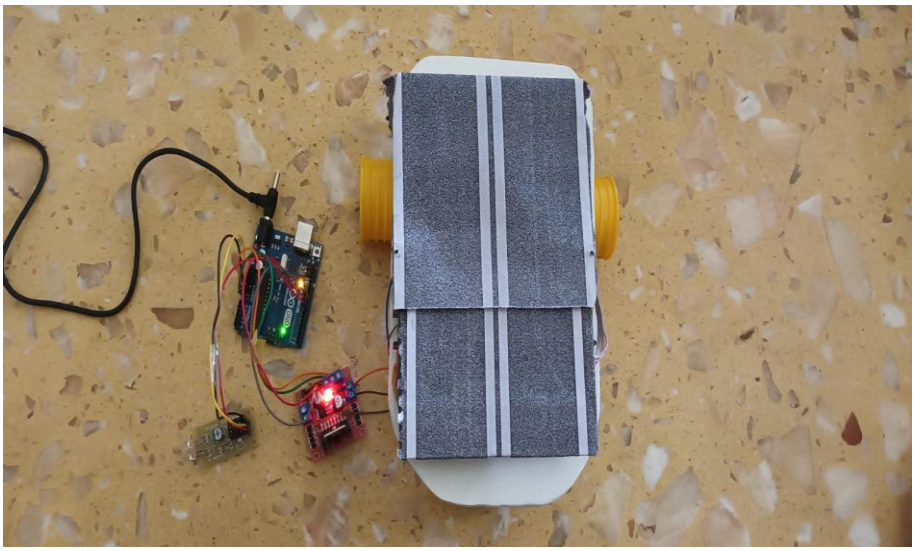
Blynk app
Blynk app can control hardware remotely, it can display sensor data, it can store data, visualize it and do many other cool things.

1.3.6 Hardware Implementation



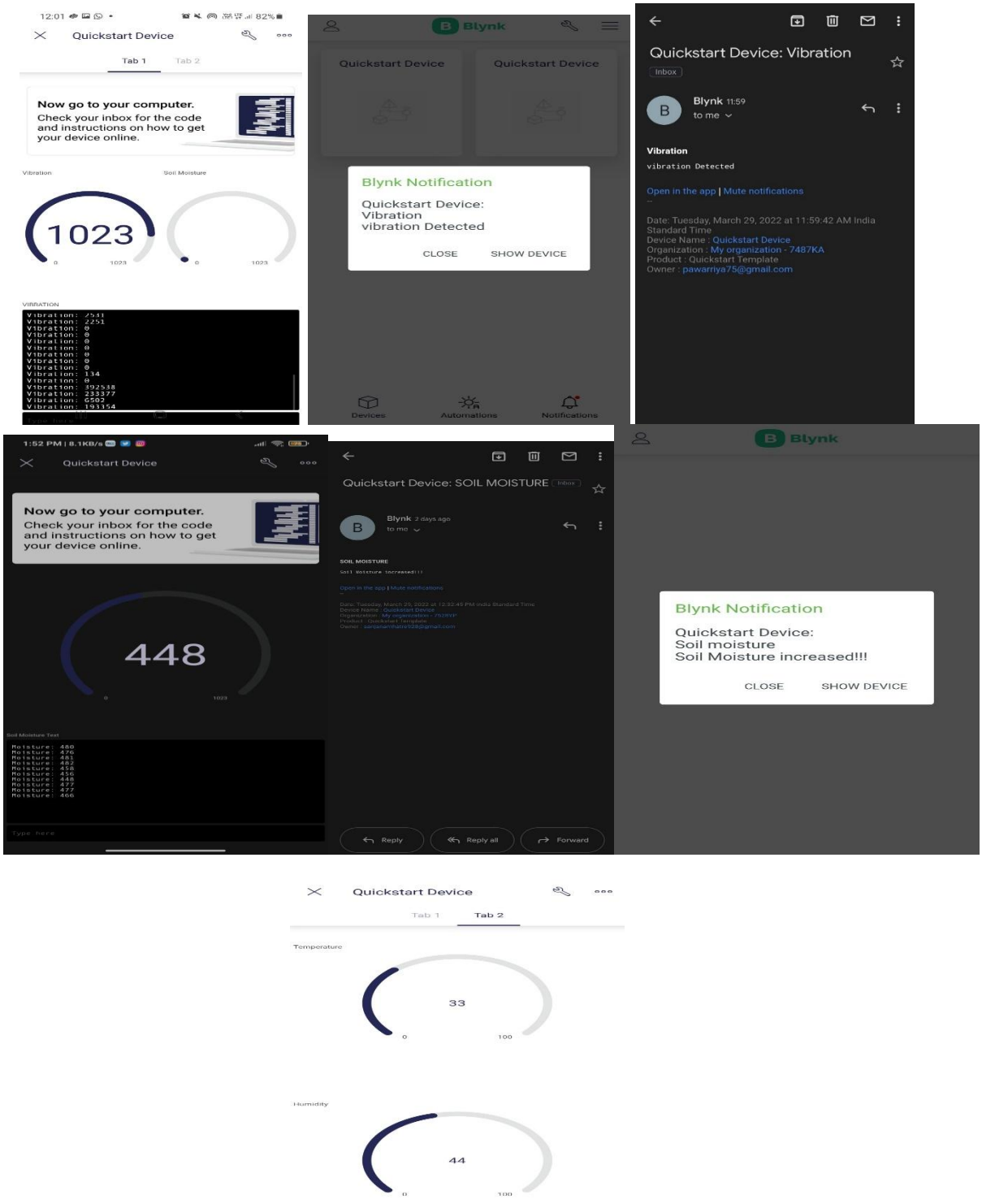






II. RESULT AND DISCUSSION

The results obtained are as discussed below: -



2.1 Application

1. This system can be used in following area: a) Hilly area b) Volcanic eruption c) Water logged
2. Real-time alerts
3.In the area where heavy rainfall occurs.
4.In Himalayan regions

5.To avoid heavier traffic congestion.
6.Avoid accidents.

III.CONCLUSION

Using the IoT based wireless sensor network technology for the Landslide detection system, many new nodes can be connected, without affecting the other nodes. Larger areas can be covered, and each area can be monitored in real-time. Many people use Lora and Xbee for developing the wireless sensor network which can be very expensive and needs complicated programming as you will need to send data from one node to the other node, then to the other node till the data is delivered to the final receiving module. Today the technology is so advanced that the internet is available everywhere, so instead of using the Lora or Xbee we can use Wi-Fi supported devices and make a complete network. All the nodes send data to the single receiving device which can be a smartphone or an IoT platform. This project describes how a sensor is actually deployed to detect landslides. For efficient delivery of real-time data to the data management center, this system uses sensors, Arduino, Wi-Fi Module, and internet. The data management centre is fitted with the software and hardware required to perform sophisticated data analysis. The results of the analysis in the form of landslide warnings and risk assessments will be provided to the residents of the region. The results of the study will be given to the region's inhabitants, in the form of landslide warnings and risk assessments. Field experiments will be carried out to determine the sensor ranges of effects for the detection of landslides induced by rainfall that may help in the development of low-cost Detection System for Landslide and movable bridge is used as temporary based when alert is generated that alert is sent to the department, then temporary bridge is open to used as temporary based to avoid the traffic and accidents.

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