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CHAPTER 1
INTRODUCTION

INTRODUCTION

In the present paper, the authors deal with the landslide issue and the associated risk management. The design of a sensor network for monitoring landslide triggering events is proposed. The network consists of web-sensors using IoT technology to share measurement results and information. The aim is to provide timely landslide hazard maps. The projected measurement system is a configurable network of wireless and smart sensors geographically distributed. The monitored area is divided in local zones, each zone is monitored by a smart sensor.

A landslide is movement of a mass of rock, debris, or earth down a slope. In monsoons the rain water percolates and develops hydraulic pressure which exceeds the elastic limit of the soil or rocks. Due to this the strain gets accumulated which forces the soil and rocks to loosen their adhesive strengths entailing landslides. Landslides destroy agricultural/forest lands, road transports, destroys earth's natural environment as a whole causing great loss to life. Landslides can also be said of "Mass Wasting", which refers to any down slope movement of soil and rock due to gravity. It causes property damage, injury and death. Also, it adversely affects a variety of resources such as water supplies, stable to an unstable condition. This change in the stability of a slope can be caused by many factors together or alone. The Natural causes, such as, ground water pressure acting to destabilize the slope, erosion at the bottom of a slope by rivers or ocean waves, earthquakes adding loads to barely stable slope, earthquake caused liquefaction destabilizing slopes. The Manmade causes, such as, deforestation, cultivation and construction which destabilizes the already fragile slopes, vibrations from machinery or traffic. Rock avalanches, debris flows, soil movement, mud flows are the various forms of landslide. Landslides occur in rocky mountainous regions like Himalayas, konkan railways, lonavala ghats and marshy regions of kerala in India. Lanslides are hazards all over the world. Hillsides with steep slopes are prone to landslides. Landslide prediction, detection and monitoring have been done by researchers for different case studies all over the world. Landslide detection can be done by using diverse methods like visual inspection using image/video processing, satellite remote sensing, using statistical methods or using machine learning algorithms. Landslide detection can also be based on data driven approaches using wireless sensor networks (WSN). The main objective to study the landslide detection is to prevent the natural calamity by detecting its early movement. This will reduce or save the human loss caused by the landslide. Also, the objective is to find a certain way in which the sensing elements should respond quickly to rapid changes of data and send this sensed data to data analysis center. The proposed WSN/Internet of things (IoT) based landslide detection and monitoring system is a low cost, robust and delay.

OBJECTIVE

Sensor networks are commonly used for environmental monitoring applications. The basic aim is to improve knowledge on the surrounding environment. Sometimes monitoring campaigns are necessary for risk assessment and management purposes. In fact, attention has to be paid towards those processes that can put people life at risk. In such cases, the main goal of the monitoring is to verify the status of our habitat in order to keep under control the quality level of life. In this manuscript, the authors focus attention on the landslide issue. Landslide is a phenomenon widely spread in the Mediterranean, and it is often cause of death and economic damages. It represents a natural process that shapes the Earth surface. As a matter of fact, it affects principally mountainous areas and zones with cut slopes. The consequences of such a process can be catastrophic when it occurs in proximity of residential areas. exposed population. Suitable measurement systems and data processing models can allow risky situations to be characterized. In this way, warning or alert events can be timely managed by means of corrective actio

CHAPTER 2

LITERATURE REVIEW

LITERATURE REVIEW

A re-view of this literature indicates that the study of landslides enables the geomorphologist to reconstruct past land forming sequences, and is an aid in the comprehension of present and future topographic processes. Whereas the civil engineer is concerned primarily with the safety factors of natural or artificial slopes, and with landslide prediction, prevention, and control, geomorphologists are concerned basically with their causes, courses of movement, and resulting surface formations. The information gained from geomorphologists and civil engineers is important to land use planners in their efforts to identify potential hazard areas.

In recent years, there has been a growing interest in applying Wireless Sensor Networks as supporting technology in a number of early-warning detection systems. Because of their ability to accurately monitor and control the physical environment despite being in a remote location. As mentioned earlier, Wireless Sensor Networks(WNS) is a perfect tool for the detection of physical and natural phenomena, especially in landslide detection.

CHAPTER 3

SCOPE OF THE PROJECT

SCOPE OF THE PROJECT

The landslide detection system is successfully implemented as a prototype. All the sensors and other stuff works as per the expectations. The system design communication is via wifi, use of GSM is also implacable for such system. The precise threshold values for each of the sensors can be obtained through detailed study on the landslides and type of soil that the system is to be implemented in. Application of such system can also be developed in future by collaborating with IT department.

3.1 FEATURES OF THE PROJECT AND ITS FUNCTIONS

- We can Register phone numbers of every traveler.
- We can Send the values of Vibration, Moisture, Rain, Latitude and longitude to the cloud
- We can Display values on the Dashboard
- If some widget becomes large, it indicates a landslide
- If land slide occurs and SMS to travelers
- Also sends alert SMS to the concerned Govt. authorities
- It can Keep record of data (Data Logging)
- Sensors we use Accelerometer (Vibration), Soil moisture, Rain, Humidity, Temperature.

CHAPTER 4

PERFORMANCE AND REQUIREMENTS

4.1 Hardware Requirements

SR. No	Components Used
1.	Esp-32
2.	Soil moisture sensors
3.	Temperature & Humidity sensor
4.	Accelerometer sensor
5.	Rain Drop sensor

Table 1

4.2 Software Requirements

SR. No	Components Used
1.	Arduino

Table 2

CHAPTER 5
FEASIBILITY STUDY

Feasibility Study

As the name implies, a feasibility study is used to determine the viability of an idea. The objective of such a study is to ensure a project is legally and technically feasible and economically justifiable. It tells us whether a project is worth the investment. In simple terms, a feasibility study involves taking judgment call on whether a project is doable. The two criteria to judge feasibility are cost required and value to be delivered.

5.1. Feasibility

1. Technical Feasibility

Assessment is centered on the technical resources available to the organization. It helps organizations assess if the technical resources meet capacity and whether the technical team is capable of converting the ideas into work system. Technical feasibility also involves evaluation of the hardware and software requirements of the proposed system.

2. Economic Feasibilty

Helps organization assess viability, cost and benefits associated with project before financial resources are allocated. It also serves as an independent project assessment, and enhances project credibility, as a result. It helps decision makers to determine the positive economic benefits to the organization that the proposed system will provide, and helps quantify them. This assessment typically involves a cost/benefits analysis of the project.

3. Legal Feasibility

Investigates if the proposed system conflicts with legal requirements like data protection act or social media laws.

4.Operational Feasibilty

This involves undertaking a study to analyse and determine whether your business needs can be fulfilled by using the proposed solution. It also measures how well the proposed system solves problem and takes advantages of opportunities identified during scope definition. Operational feasibility studies also analyse how the project plan satisfies the requirement identified in the requirement analysis phase of the system development. Scheduling feasibility is the most important for project success. A project will fail if not completed on time.

5.2 Security

Security is also an important consideration in the build process. A few additional steps can improve the security of a deployed app and help prevent unauthorized reverse engineering, spoofing, or other attacks. Dotfuscator is free and helps to protect. NET assemblies from reverse-engineering and unauthorized use such as unauthorized debugging. Strong-name signing can be used to uniquely identify software components and prevent name spoofing.

5.3 Reliability

In this section we have reviewed 12 case studies to understand the reliability measures that are undertaken worldwide. We have considered only local-level early warning systems for landslides and debris flow primarily due to rainfall/snow.

5.4 Portability

The rising machine learning (ML) models have become the preferred way for landslide detection based on remote sensing images, but the performance of these models in a sample-free area are rarely concerned in many studies. In this study, we used a cross-validation method (training model in one area and validation in another) to compare the model portability of trained ML models applied in an "off-site" area, as a consideration of the landslide detection ability of these models in sample-free areas. We integrate nighttime light imagery, multi-seasonal optical Landsat time-series and digital elevation data, and we employed support vector machines (SVM), artificial neural networks (ANN) and random forest (RF) models to classify the satellite imagery and identify landslides. Samples of two scenarios generated from two subareas of the Jiuzhaigou disaster-stricken region are used for the cross-application and accuracy evaluation of three ML models. The results revealed that when the trained models are applied in areas outside those in which they were developed, the landslide identification accuracy of these three models has declined.

5.5 Extensibility

Global physical event detection has traditionally relied on dense coverage of physical sensors around the world; while this is an expensive undertaking, there have not been alternatives until recently. The ubiquity of social networks and human sensors in the field provides a tremendous amount of real-time, live data about true physical events from around the world. However, while such human sensor data have been exploited for retrospective large-scale event detection such as hurricanes or earthquakes, there has been limited to no success in exploiting this rich resource for general physical event detection. Prior implementation approaches have suffered from the concept drift phenomenon, where real-world data exhibits continuous, unknown, and unbounded changes in its data distribution, making static machine learning models ineffective in the long term. We propose and implement an end-to-end collaborative drift adaptive system that integrates corroborative and probabilistic sources to deliver real-time predictions. Furthermore, our system is adaptive to concept drift and performs automated continuous learning to maintain high performance. We demonstrate our approach in a real-time demo available online for landslide disaster detection, with extensibility to other real-world physical events such as flooding, wildfires, hurricanes, and earthquakes.

CHAPTER 6
SYSTEM DESIGN

6.1 UML Diagrams

The Unified Modelling Language (UML) is a general-purpose, developmental, modelling language in the field of software engineering that is intended to provide a standard way to visualize the design of a system. The notation supplies a rich set of graphic elements for modelling object-oriented elements, and the rules say how those elements may be connected and used. UML is not a prescriptive process for creating software systems - it does not supply a method or process, simply the language. You can therefore use UML in a variety of ways to specify and develop your software engineering project. Enterprise Architect supports many different kinds of UML elements (as well as some custom extensions). Together with the links and connectors between elements, these form the basis of the model. In addition to the base UML elements, the modelling environment can be extended using UML Profiles. A Profile is a set of stereotyped and tagged elements that together solve some modelling problem or scenario. Examples are UML Profiles for modelling XML Schema or Business Process Modelling.

6.1.1 Use Case Diagrams

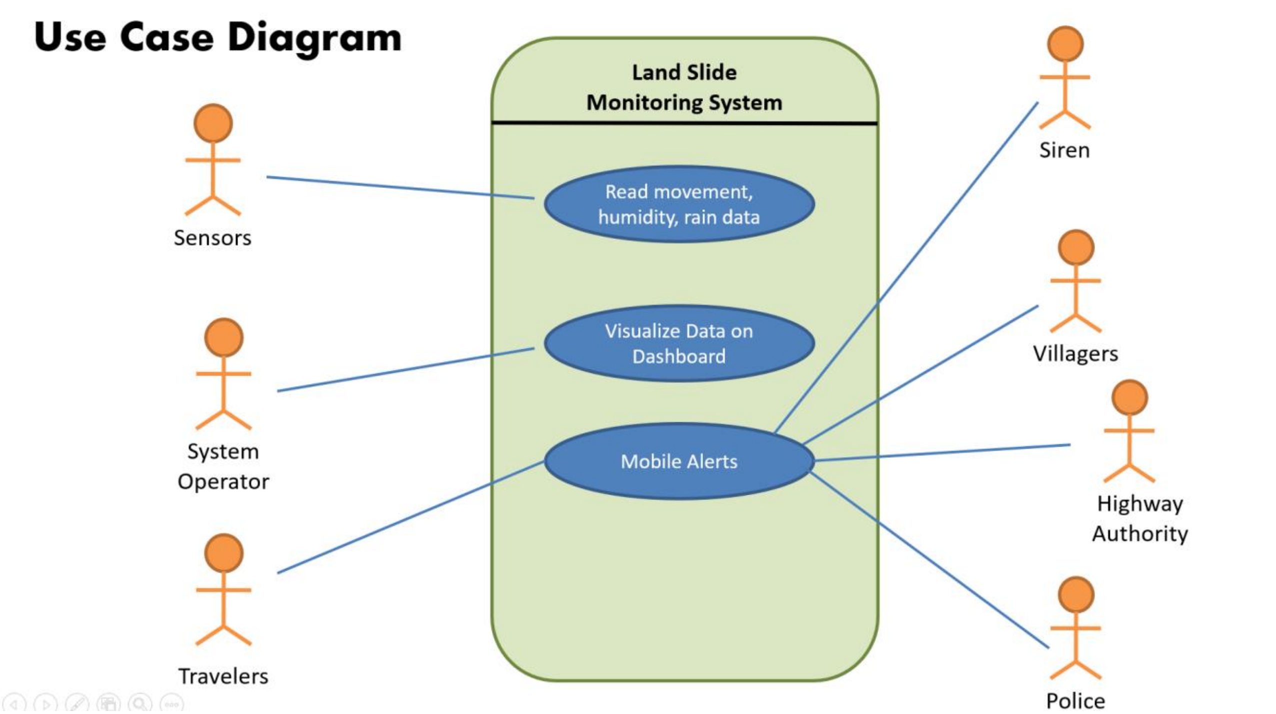


Fig6.1. Use Case Diagram

A use case diagram is a graphical depiction of a user's possible interactions with a system. Figure 4 shows Use Case Diagram of our project. A use case diagram shows various use cases and different types of users the system has and will often be accompanied by other types of diagrams as well. The use cases are represented by either circles or ellipses. The actors are often shown as stick figures. While a use case itself might drill into a lot of detail about every possibility, a use-case diagram can help provide a higher-level view of the system. It has been said before that "Use case diagrams are the blueprints for your system.” Due to their simplistic nature, use case diagrams can be a good communication tool for stakeholders. The drawings attempt to mimic the real world and provide a view for the stakeholders to understand how the system is going to be designed. Siau and Lee conducted research to determine if there was a valid situation for use case diagrams at all or if they were unnecessary. What was found was that the use case diagrams conveyed the intent of the system in a more simplified manner to stakeholders and that they were "interpreted more completely than class diagrams". The purpose of a use case diagram is to capture the dynamic aspect of a system. They provide a simplified graphical representation of what the system should do in a use case.

6.1.2 Class Diagram

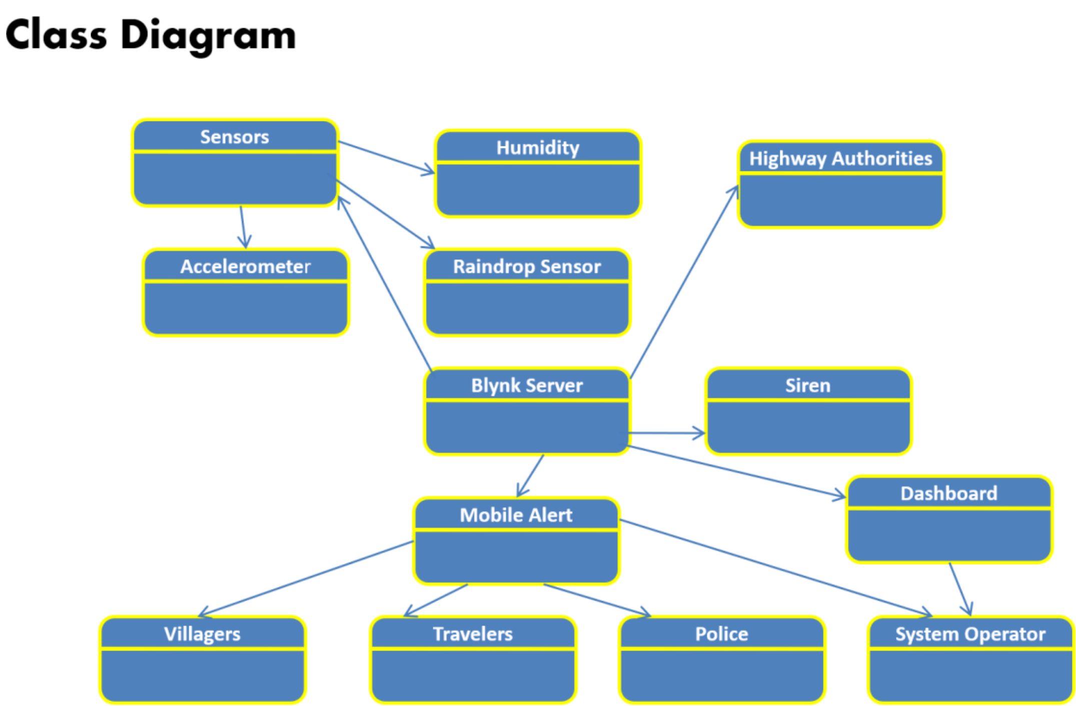
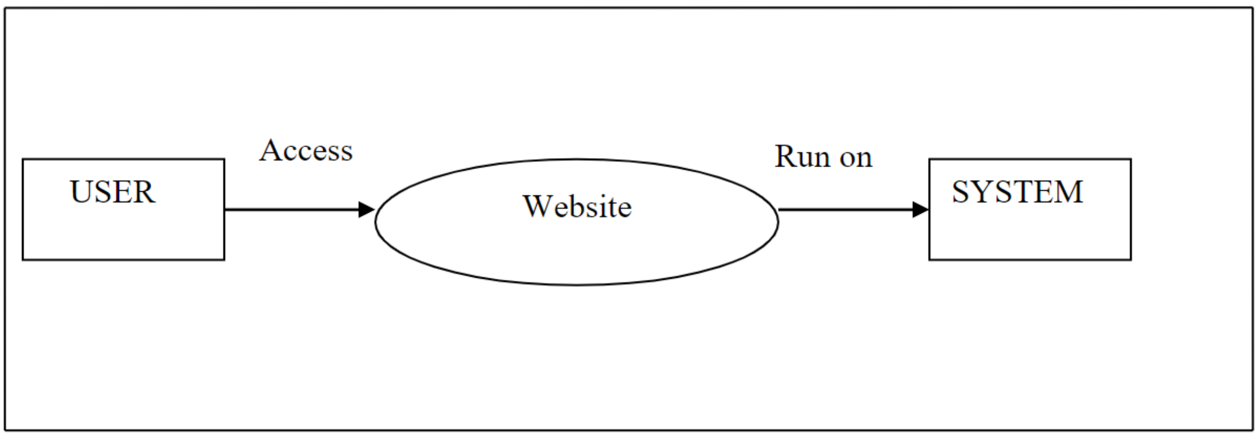


Fig6.2. Class Diagram

6.2 DFD Diagrams

6.2.1 Data Flow Diagrams [DFD]

6.2.1.1 DFD LEVEL 0



6.2.1.2 DFD LEVEL 1

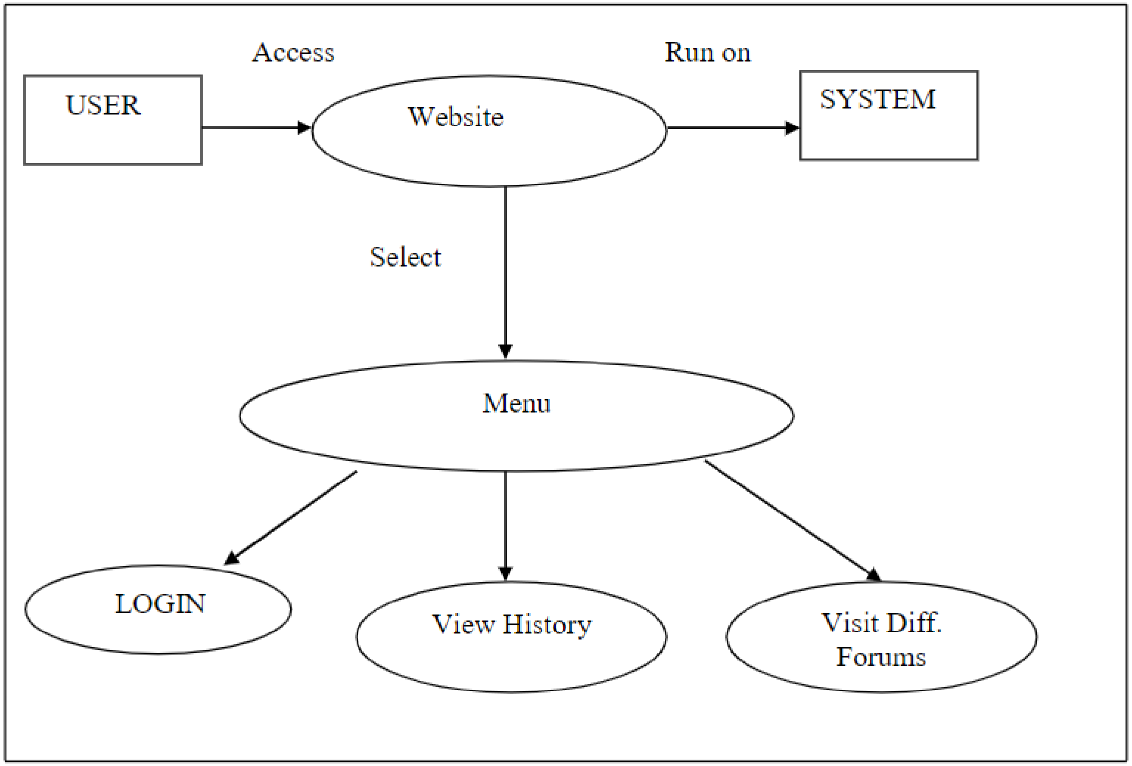


Fig6.4. DFD LEVEL 1

CHAPTER 7

PLATFORM DATABASE DESCRIPTION

7.1 Development Tools

1.Aurduino

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

Arduino board designs use a variety of microprocessors and controllers. The boards are equipped with sets of digital and analog input/output (I/O) pins that may be interfaced to various expansion boards ('shields') or breadboards (for prototyping) and other circuits. The boards feature serial communications interfaces, including Universal Serial Bus (USB) on some models, which are also used for loading programs. The microcontrollers can be programmed using the C and C++ programming languages, using a standard API which is also known as the Arduino language, inspired by the Processing language and used with a modified version of the Processing IDE. In addition to using traditional compiler toolchains, the Arduino project provides an integrated development environment (IDE) and a command line tool developed in Go.

2.Blynk Console

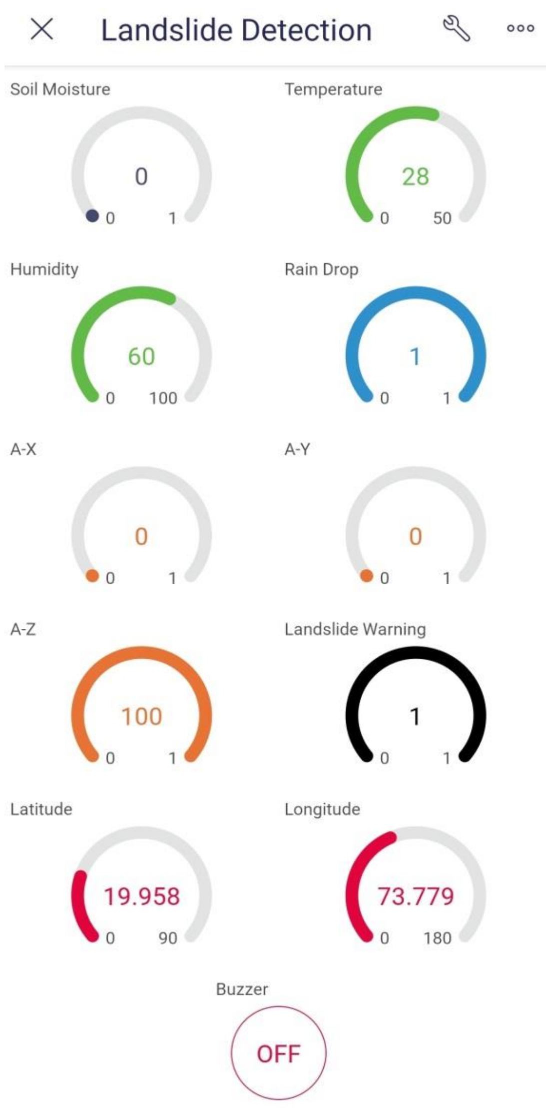


Fig7.1 Blynk Console

CHAPTER 8

SCREEN LAYOUTS

8.1 Code for sensors:-

```
#define BLYNK_PRINT Serial\
#define BLYNK_TEMPLATE_ID "TMPLEf1p5GXP"
#define BLYNK_DEVICE_NAME "Mountain A IOT"

#include <WiFi.h>
#include <WiFiClient.h>
#include <BlynkSimpleEsp32.h>
#include <Wire.h>

#include "DHT.h"
#define DHTTYPE DHT11
#define dhtPin 13
DHT dht(dhtPin, DHTTYPE);

char auth[] = "UMrR6JMt4T5Rh8i9ooNxgsq0JI6vFWbE";
char ssid[] = "BSNL FIBER";
char pass[] = "0123456789";

const int MPU_addr = 0x68; // I2C address of the MPU-6050
int16_t AcX, AcY, AcZ, Tmp, GyX, GyY, GyZ;
float t;
float h;
int moistureValue;
int warning;
```

```
int raindropPin = 14;
int moisturePin = 15;
float latitude = 19.9579;
float longitude = 73.7787;

void setup()
{
  Serial.begin(9600);
  Blynk.begin(auth, ssid, pass);
  Wire.begin();
  Wire.beginTransmission(MPU_addr);
  Wire.write(0x6B);  // PWR_MGMT_1 register
  Wire.write(0);     // set to zero (wakes up the MPU-6050)
  Wire.endTransmission(true);
  Serial.println("Wrote to IMU");
  Serial.println("Connecting to ");
  pinMode(2, OUTPUT);
  pinMode(raindropPin, INPUT);
  dht.begin();
  pinMode(dhtPin, INPUT);
  delay(2000);
}

void loop()
{
  Blynk.run();
  mpu_read();
  if (AcX < -11000)
  {
    Serial.println("Landslide");
    digitalWrite(2, HIGH);
```

```
  delay(500);
  digitalWrite(2, LOW);

  //warning=1;
  Blynk.virtualWrite(V8, 1);
  Blynk.virtualWrite(V8, 1);
  Blynk.virtualWrite(V8, 1);
  Blynk.virtualWrite(V8, 1);
}
else
{
  Serial.println("Normal");
  Blynk.virtualWrite(V8, 0);
}


//------Raindrop sensor -----
int raindropValue = digitalRead(raindropPin);
Serial.print("Raindrop:");
Serial.println(raindropValue);
Blynk.virtualWrite(V3, raindropValue);


//------ DHT11 sensor -----
t = dht.readTemperature();
h = dht.readHumidity();
Serial.print("humidity = ");
Serial.println(h);
Serial.print("temperature = ");
Serial.println(t);
Blynk.virtualWrite(V1, t);
```

```
  Blynk.virtualWrite(V2, h);



  //------ Soil moisture -----
  moistureValue = analogRead(moisturePin);
  Serial.print("Soil moisture value:");
  Serial.println(moistureValue);
  Blynk.virtualWrite(V0, moistureValue);



  /// -----Location ----
  Blynk.virtualWrite(V9, latitude);
  Blynk.virtualWrite(V10, longitude);
}

void mpu_read()
{
  Wire.beginTransmission(MPU_addr);
  Wire.write(0x3B);
  Wire.endTransmission(false);
  Wire.requestFrom(MPU_addr, 14, true); // request a total of 14 registers
  AcX = Wire.read() << 8 | Wire.read(); // 0x3B (ACCEL_XOUT_H) & 0x3C (ACCEL_XOUT_L)
  AcY = Wire.read() << 8 | Wire.read(); // 0x3D (ACCEL_YOUT_H) & 0x3E (ACCEL_YOUT_L)
  AcZ = Wire.read() << 8 | Wire.read(); // 0x3F (ACCEL_ZOUT_H) & 0x40 (ACCEL_ZOUT_L)

  //  Blynk.virtualWrite(V0, AcX);
  //  Blynk.virtualWrite(V1, AcY);
  //  Blynk.virtualWrite(V2, AcZ);

  float Axnorm = float(AcX / 16384);
  float Aynorm = float(AcY / 16384);
```

```
  float Aznorm = float(AcZ / 16384);


  Serial.print("Accelerometer Values: \n");
  Serial.print("AcX: "); Serial.print(AcX); Serial.print("\nAcY: "); Serial.print(AcY); Serial.print("\nAcZ: ");
Serial.print(AcZ);


  //  Serial.print("Accelerometer normalized Values: \n");
  //  Serial.print("AcX: "); Serial.print(Axnorm); Serial.print("\nAcY: "); Serial.print(Aynorm);
Serial.print("\nAcZ: "); Serial.print(Aznorm);
  delay(50);
  Serial.println();
  Serial.println();


}
```

8.2 Code for village buzzer:-

```
#define BLYNK_PRINT Serial
#define BLYNK_TEMPLATE_ID "TMPLEf1p5GXP"
#define BLYNK_DEVICE_NAME "Mountain A IOT"

#include <WiFi.h>
#include <WiFiClient.h>
#include <BlynkSimpleEsp32.h>
#include <Wire.h>

char auth[] = "UMrR6JMt4T5Rh8i9ooNxgsq0JI6vFWbE";
char ssid[] = "Vaishu";
char pass[] = "vaishu310";

int buzzPin = 26;
int warning;

BLYNK_WRITE(V8)
{
  Blynk.syncVirtual(V8);
  warning = param.asInt(); // Read data of button from pin V2
  Serial.print("Landslide warning is: ");
  Serial.println(warning);
}

void setup()
{
  Serial.begin(9600);
  Blynk.begin(auth, ssid, pass);
  pinMode(buzzPin, OUTPUT);
```

```
}

void loop()
{
  Blynk.run();
  Serial.print("Landslide warning is: ");
  Serial.println(warning);
  if (warning == HIGH)
  {
    digitalWrite(buzzPin, HIGH);
    delay(2000);
    digitalWrite(buzzPin, LOW);
  }
  else
  {
    digitalWrite(buzzPin, LOW);
  }
}

BLYNK_CONNECTED()
{
  Blynk.syncVirtual(V8);
  //Blynk.syncVirtual(V1);
}
```

CHAPTER 9

SYSTEM TESTING

9.1 Introduction

System testing is testing conducted on a complete integrated system to evaluate the system's compliance with its specified requirements. System testing takes, as its input, all of the integrated components that have passed integration testing. The purpose of a system test is to evaluate the end-to-end system specifications. Usually, the software is only one element of a larger computer-based system. Ultimately, the software is interfaced with other software/hardware systems. System Testing is actually a series of different tests whose sole purpose is to exercise the full computer-based system. System Testing is a Black Box Testing. There are two types of System Testing:

1. White Box Testing
2. Black Box Testing

9.2 White Box Testing

White-box testing is a method of software testing that tests internal structures or workings of an application, as opposed to its functionality. It is also known as glass box is testing, structural testing, clear box testing, open box testing and transparent box testing. It tests internal coding and infrastructure of a software focus on checking of predefined inputs against expected and desired outputs. It is based on inner workings of an application and revolves around internal structure testing. In this type of testing programming skills are required to design test cases. The primary goal of white box testing is to focus on the flow of inputs and outputs through the software and strengthening the security of the software.

9.3 Black Box Testing

Black-box testing is a method of software testing that examines the functionality of an application without peering into its internal structures or workings. It is also known as Behavioral Testing. The primary source of black box testing is a specification of requirements that is stated by the customer. In this method, tester selects a function and gives input value to examine its functionality, and checks whether the function is giving expected output or not. If the function produces correct output, then it is passed in testing, otherwise failed.

9.4 Test Plan

Unit testing

Test Case Id: LD_01				Test Designed By: Siddhi .H. Bagul		
Priority (Low/Medium/High): Medium				**Test Designed Date**:22/05/2022		
Module Name: IOT Based Landslide Detection & monitoring system				**Test Executed By:** Siddhi .H. Bagul		
Test Title: Testing the Working of Sensors				**Test Execution Date:**23/05/2022		
Description: This will ensure the proper working of the sensors						
ID	**Testcases**	**Preconditions**	**Test Data**	**Expected Result**	**Actual Result**	**State**
1.	To check humidity sensor working or not	Humidity sensor connected to the ESP32 dev module	Program should be written in Arduino	It should be displayed in serial monitor/ Blynk app/ Blynk server	Humidity Displayed	PASS
2.	To check temperature sensor working	DHT11 sensor connected to the ESP32 dev module	Program should be written in Arduino	It should display the value of temperature in serial monitor/ Blynk server/ Blynk app	Temperature Displayed	PASS
3.	To check working of soil moisture sensor	Soil moisture sensor connected to the ESP32 dev module	Program should be written in Arduino	It should display the value of soil moisture in serial monitor/ Blynk server/ Blynk app	Soil moisture Displayed	PASS
4.	To check working of Raindrop sensor	Raindrop sensor connected to the ESP32 dev module	Program should be written in Arduino	It should display value of Raindrop in serial monitor/ Blynk server/ Blynk app	Raindrop value Displayed	PASS
5.	Accelerometer Sensor is working or not	Accelerometer sensor connected to the ESP32 dev module	Program should be written in Arduino	It should display vibration value in serial monitor/ Blynk server/ Blynk app	Vibrations Displayed	PASS
Post-Condition: The sensor are working as expected						

System testing

<table>
<tr><td colspan="4">Test Case Id: LD_01</td><td colspan="3">Test Designed By: Siddhi .H. Bagul</td></tr>
<tr><td colspan="4">Priority (Low/Medium/High): Medium</td><td colspan="3">Test Designed Date:22/05/2022</td></tr>
<tr><td colspan="4">Module Name: IOT Based Landslide Detection & monitoring system</td><td colspan="3">Test Executed By: Siddhi .H. Bagul</td></tr>
<tr><td colspan="4">Test Title: Testing the Working of Sensors</td><td colspan="3">Test Execution Date:23/05/2022</td></tr>
<tr><td colspan="7">Description: Test will ensure proper working of tools</td></tr>
<tr><td>ID</td><td>Testcases</td><td>Preconditions</td><td>Test Data</td><td>Expected Result</td><td>Actual Result</td><td>State</td></tr>
<tr><td>1.</td><td>To check Blynk app/ Blynk server is working or not</td><td>To check Blynk app connected to Arduino IDE or not</td><td>Library of blynk should be installed Arduino IDE</td><td>Data should be displayed on Blynk server / Mobile GUI</td><td>Data Displayed</td><td>PASS</td></tr>
<tr><td>2.</td><td>To check Buzzer is working or not</td><td>Buzzer is connected to the ESP32 dev module</td><td>Program should be written in Arduino</td><td>Buzzer should be used in village area</td><td>Alert Generated</td><td>PASS</td></tr>
<tr><td colspan="7">Post-Condition: Tools are working as expected</td></tr>
</table>

CHAPTER 10
FUTURE SCOPE

Future scope

The landslide detection system is successfully implemented as prototype. All the sensors and other stuff works as per the expectations. The system designs communication is via wifi, use of GSM is Also implacable for such system. The precise threshold values for each of the sensors can be obtained through detailed study on landslides and type of soil that the system is to be implemented in. Application of such system can also be developed in future by collaborating with IT department.

CHAPTER 11

ADVANTAGES

ADVANTAGES

- SEISMIC Hazard landslide and Earthquake monitoring.
- Safety for the humans and vehicles.
- real time monitoring.
- It gives us alert message before landslide.
- No need of lengthy wires.

CHAPTER 12
DISADVANTAGES

DISADVANTAGES

- In mountain area it is difficult to power supply.
- It is difficult to insure security of the system from unknown persons.(if any one take sensor ,it is hard to provide security

CHAPTER 13
CONCLUSION

CONCLUSION

Real-time monitoring of landslides is one of the challenging research areas available today **in** the field of geophysical research.

The IoT based landslide detection system is to detect those conditions which lead to the occurrence of landslide and notify it well before time and able to save the human loss.

The current landslide detection systems are less accurate. Here the proposed system is a real-time monitoring system and more accurate too. It is also very easy to set up. All the current systems are not completely automatic. They all require human interaction at some point. Here the proposed system is completely free of human interruption.

The system is a robust and delay efficient system. It predicts occurrence of landslide at early stages thereby reducing the fatalities due to landslide.

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CERTIFICATES

First International Conference on IC-RTETM-2022

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First International Conference on

"Recent Trends in Engineering Science, Technology and Management (IC-RTETM-2022)"

(23rd to 25th February 2022)

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KNOWLEDGE IS DIVINE

CERTIFICATE

This certificate Acknowledges and Honours Prof./ Dr. / Mr./Ms. Vaishnavi Nitin Patil For participating / presenting paper entitled Survey on IOT Based Landslide Detecting & Monitoring System In the First International Conference on "Recent Trends in Engineering Science, Technology and Management (IC-RTETM-2022)" held on 23rd to 25th February 2022 at GGSP, Nashik.

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ICRTETM2022

First International Conference on

"Recent Trends in Engineering Science, Technology and Management (IC-RTETM-2022)"

GGSF GURU GOBIND SINGH FOUNDATION ESTD 1978

(23^{rd} to 25^{th} February 2022)

CERTIFICATE

This certificate Acknowledges and Honours Prof./ Dr. / Mr./Ms. Siddhi Hitesh Bagul For participating / presenting paper entitled Survey on IOT Based Landslide Detection & Monitoring System In the First International Conference on "Recent Trends in Engineering Science, Technology and Management (IC-RTETM-2022)" held on 23^{rd} to 25^{th} February 2022 at GGSP, Nashik.

Organized By
Department of Computer Engineering
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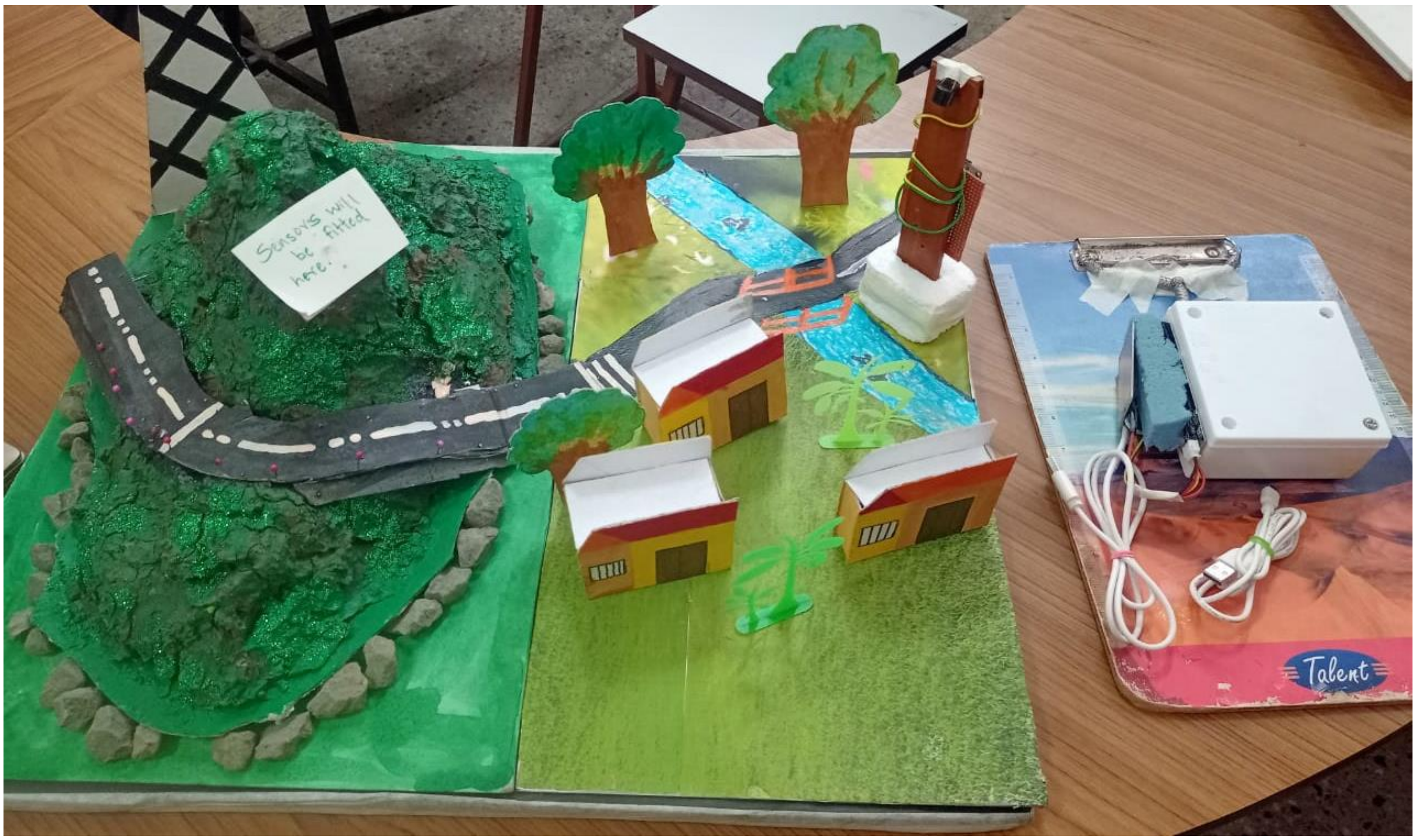

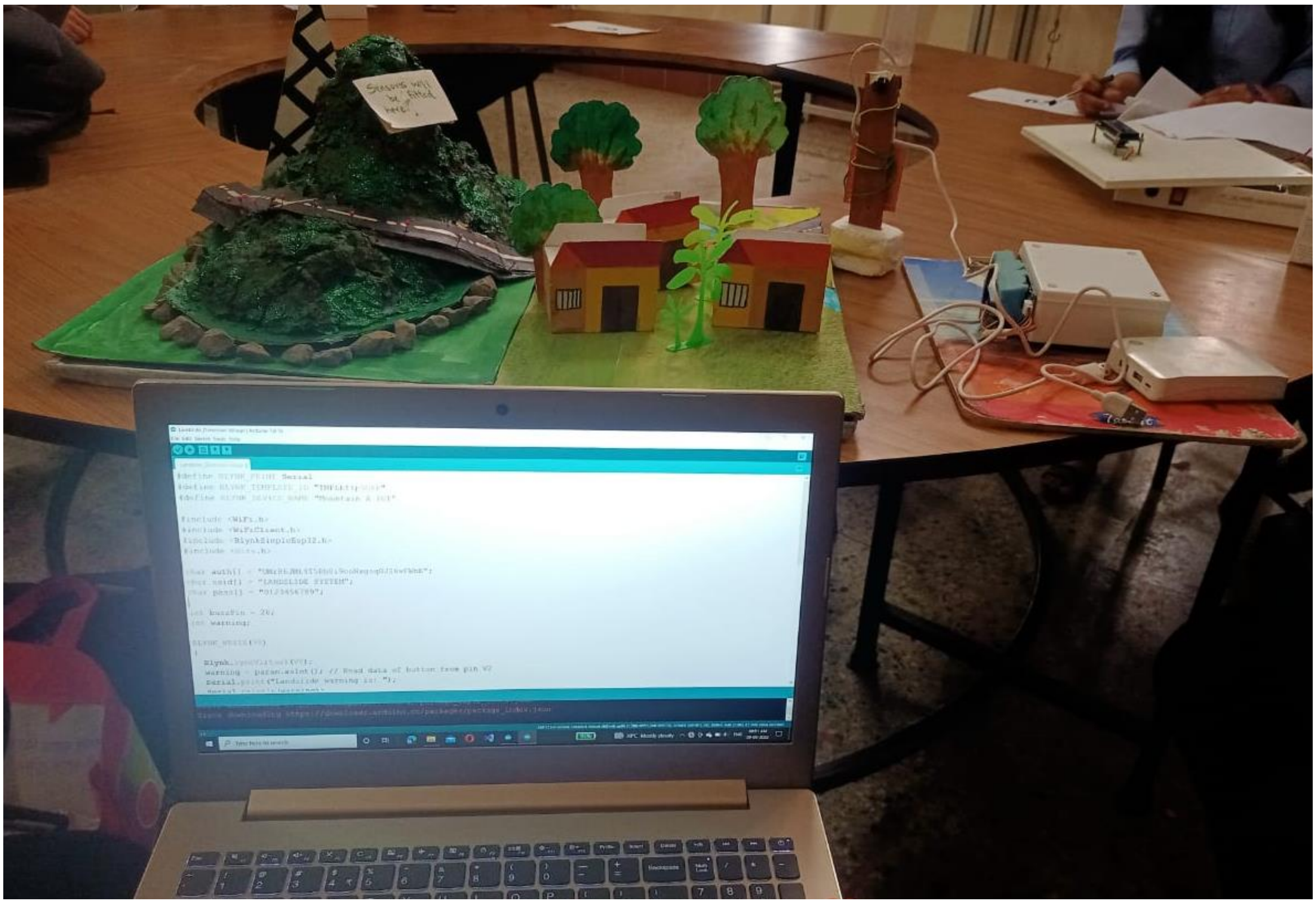
Sensors will be fitted here.
#include <WiFi.h>
char ssid[] = "LANDSLIDE SYSTEM";
int warning;
Serial.print("Landslide warning is: ");