Internship Title: IOT Based Landslide Prediction and Prevention.

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GitHub Link: https://github.com/Tinkerers-Lab-VESIT-ETRX/IoT-based-landslide-prediction-and-prevention-2

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INTRODUCTION

A. Existing Problem:

Every year, landslides are a natural disaster that disrupts social life. It is the movement of a large pile of stones or rubble down a slope. It happens as a result of natural or man-made events. The continent of Asia was found to be the most affected, with 75 percent of landslides occurring there. Human lives were also lost in India due to landslides in Kerala last year during the monsoon season. The main aim of the proposed system is to detect those conditions which leads to the occurrence of landslide and notify it well before time so that necessary steps can be taken to reduce or save the human loss.

Effects: The slope/hill is destroyed, and all vegetation is removed. Houses and occasionally entire villages are buried. The slope is weakened, making it more vulnerable to additional landslides.

B. Overview:

Landslide detection system based on the IoT "Internet of Things" and the Wireless Sensor Network. This is a high-level project that can track the earth's vibrations, temperature, humidity, and soil moisture. All of these sensors are connected to various IoT Nodes, which form the entire network. The number of nodes can be increased or lowered depending on the situation. The website is used to keep track of all the Landslide detecting nodes.

C. Purpose:

Main Purpose: Early detection of landslides in order to prevent loss of life and livestock.
Functional Purpose: To get real-time readings from the database and display the values of various sensors on the WebApp in the form of a graph.

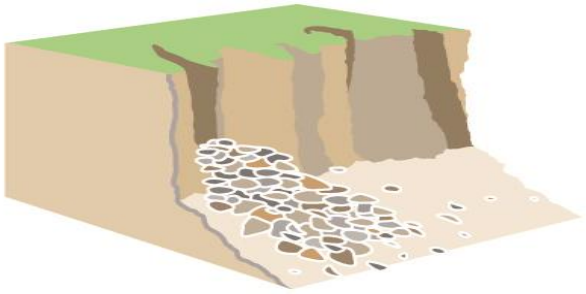
LITERATURE REVIEW

Avalanche is a cataclysmic catastrophe that repeatedly harms public activity. It could be described as the progression of a mass of rock and debris down a slope. It happens as a result of natural or man-made events. Asia was discovered to be the most influenced landmass where 75% of avalanches happened. India likewise confronted the loss of people because of avalanches which happened last year during storm in kerala. The suggested framework's main purpose is to identify the conditions that lead to an avalanche and to warn people about it ahead of time so that critical steps can be taken to reduce or prevent human loss.

Types of Landslides

Rock Falls

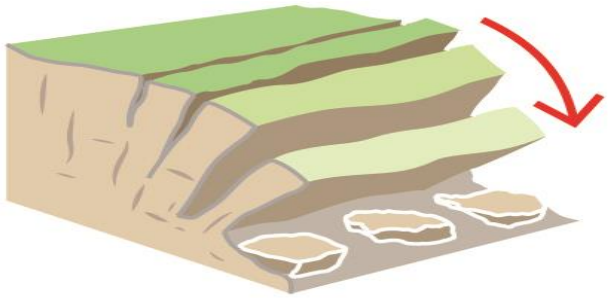
Falls are landslides that occur when debris from a cliff or steep slope collapses. Falls usually feature a combination of free fall, bouncing, and rolling. A fall-type landslide occurs when rock or debris collects near the slope's base.



Rock fall

Rock Topples

A topple failure is the forward rotation and movement of a pile of rock, earth, or debris out of a slope. This sort of slope failure usually occurs around or at the block's base, around an axis (or point).



Rock topple

Talus Cones

A topple frequently results in the production of rubble or a debris cone at the slope's base, which is referred to as a talus cone. There are no plants developing on new talus cones. Weeds and even trees can grow on old talus cones.

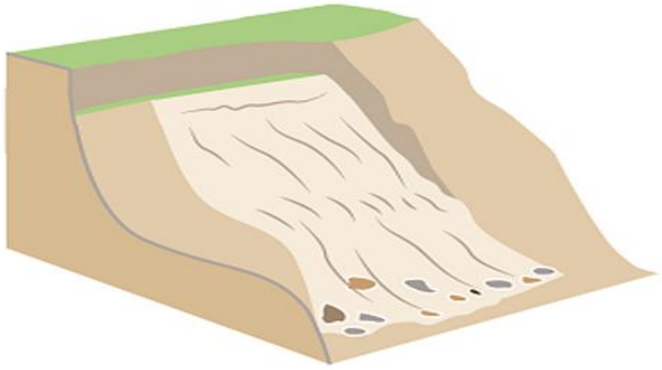
Limestone talus cone in the Allt nan Uamh, Assynt

Slides

A slide-type landslide occurs when debris moves downslope along a clear rupture or slip surface. The slip surface is usually deeper than in other types of landslides and is not structurally regulated. The top of these landslides has a noticeable main scarp and a back-tilted bench or block, with little interior deformation. Movement is more or less rotational about an axis below this point. Slides are defined by a material failure at deep followed by movement along a rupture or slip surface. Rotational slides (slumps) and translational (planar) slides are the two types of slide failure.

- **Rotational slides**

  The slide is said to be rotational if the slip surface is listric (curved or spoon-shaped). The Holbeck Hall landslide in Scarborough, North Yorkshire, is an excellent example of a rotational landslide.

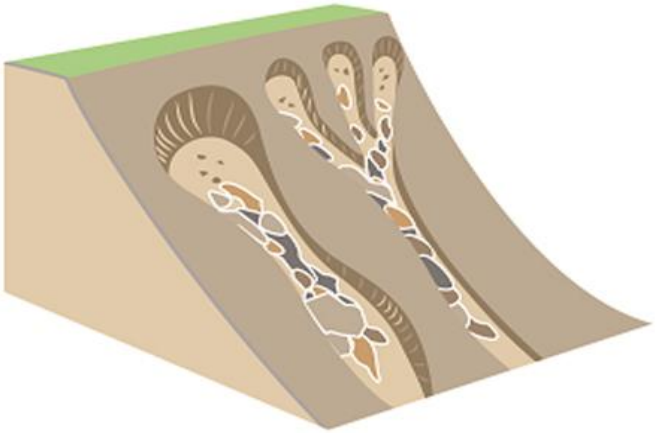


- **Translational slides**

  A downslope movement of material over a characteristic planar surface of weakness, such as a fault, joint, or bedding plane, is known as a translational or planar landslide. Translational landslides are responsible for some of the world's largest and most destructive landslides. These landslides are not self-stabilizing and occur at all scales. Where there are steep discontinuities, they can be quite fast.

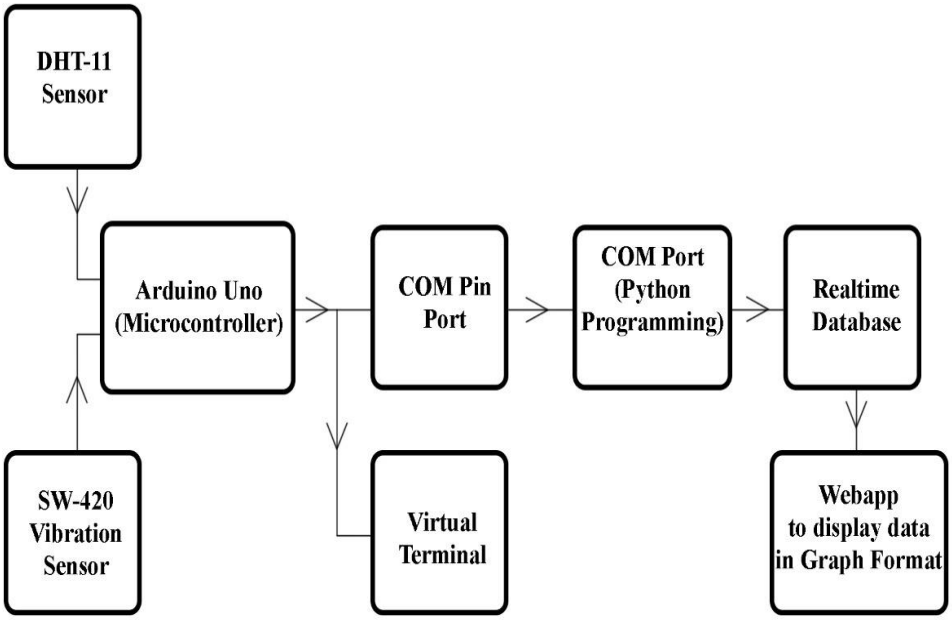
- **Flows**

  Flows are landslides in which material is transported down a slope in the form of a fluid. Where the landslide material has ceased moving, a distinctive, upside-down funnel-shaped deposit is often left behind. Flows can be classified as mud, debris, or rock (rock avalanches).

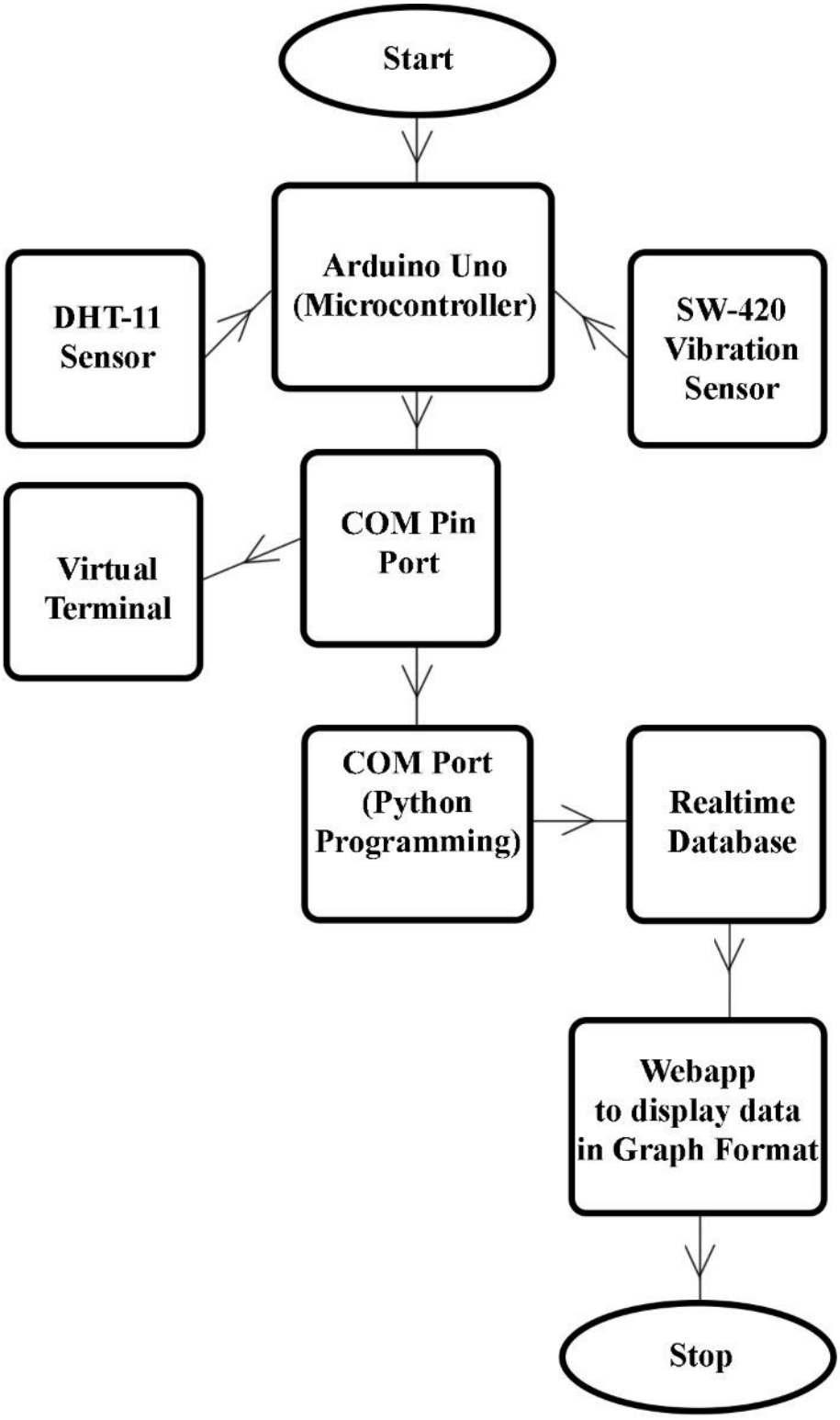


PROPOSED SOLUTION

A. BLOCK DIAGRAM

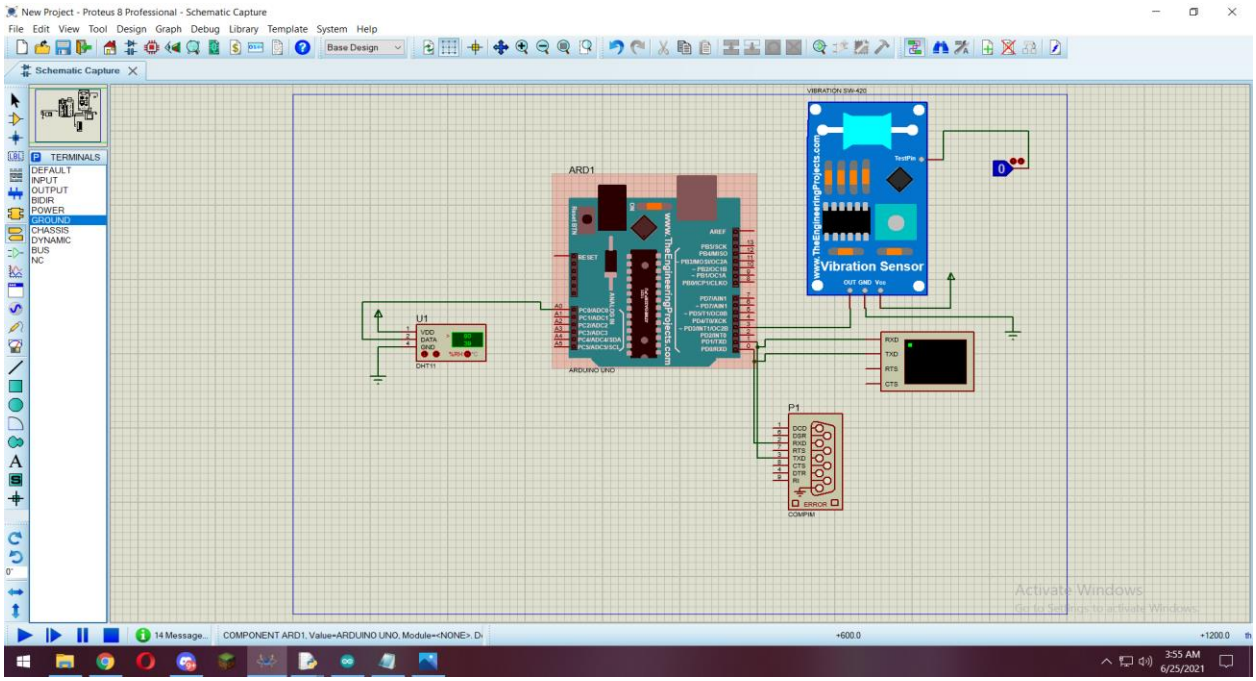


B. FLOWCHART

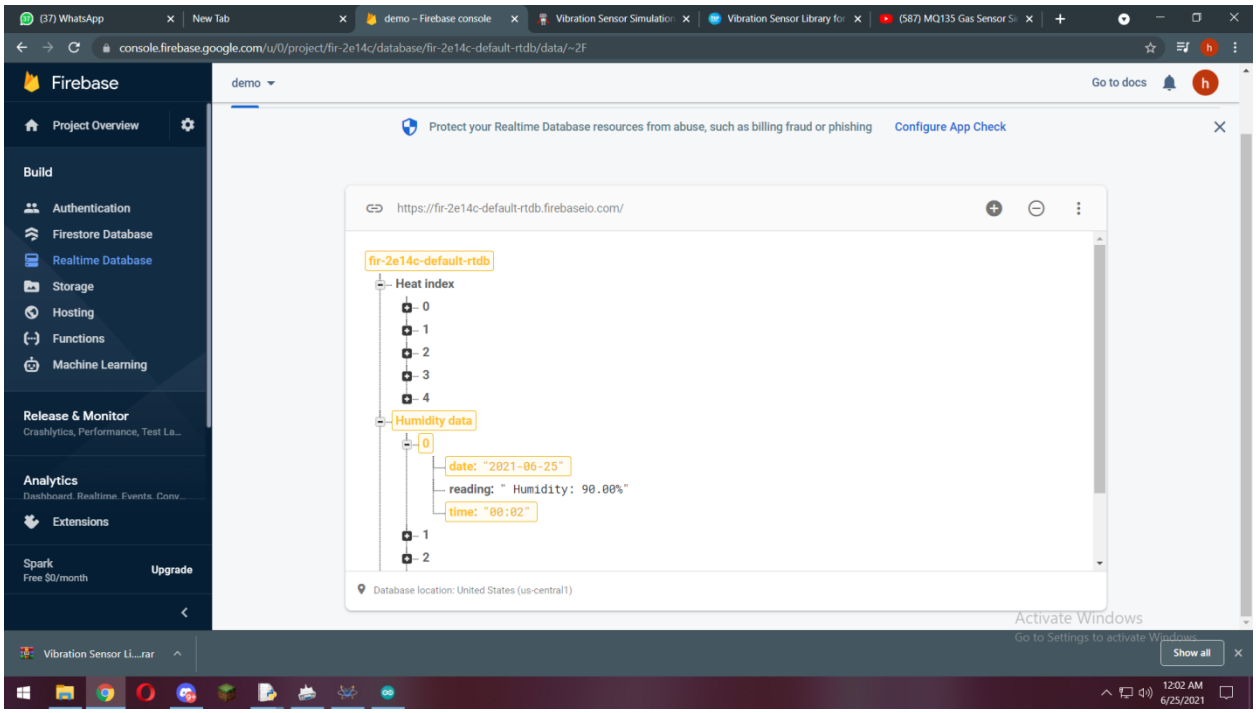

Start
Arduino Uno (Microcontroller)
DHT-11 Sensor
SW-420 Vibration Sensor
COM Pin Port
Virtual Terminal
COM Port (Python Programming)
Realtime Database
Webapp to display data in Graph Format
Stop

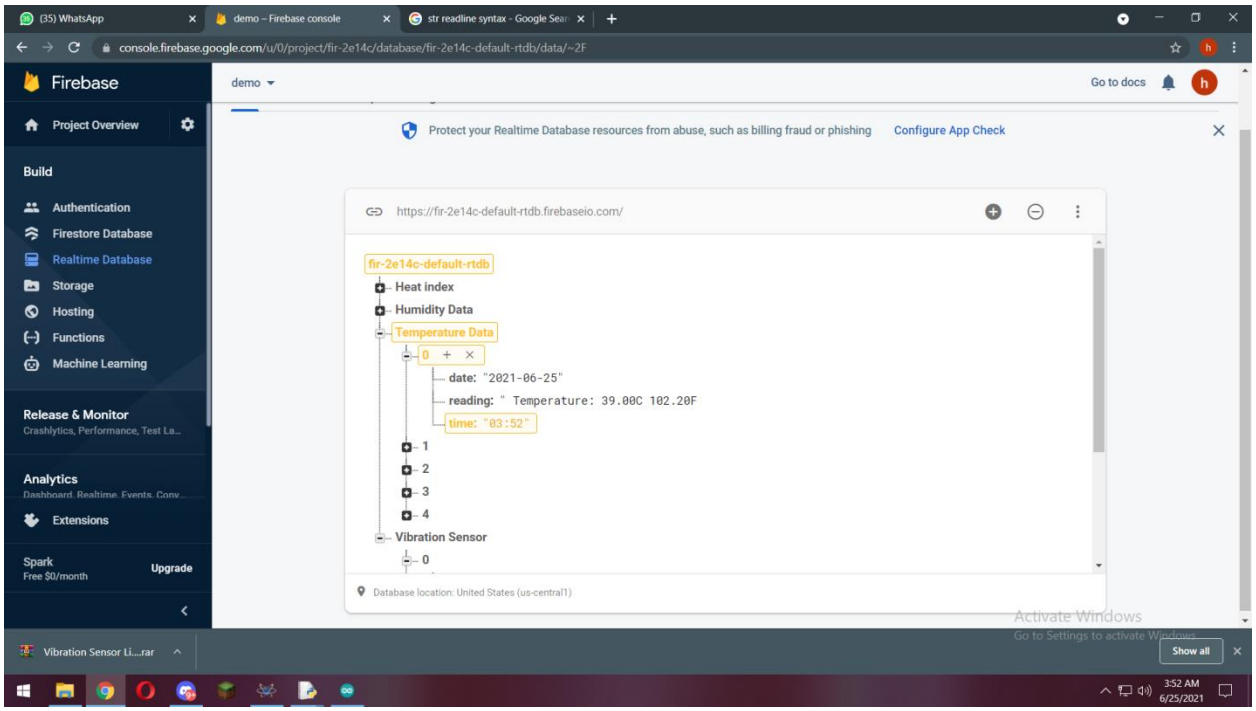
RESULT

A. Fullscreen Screenshot of proteus.

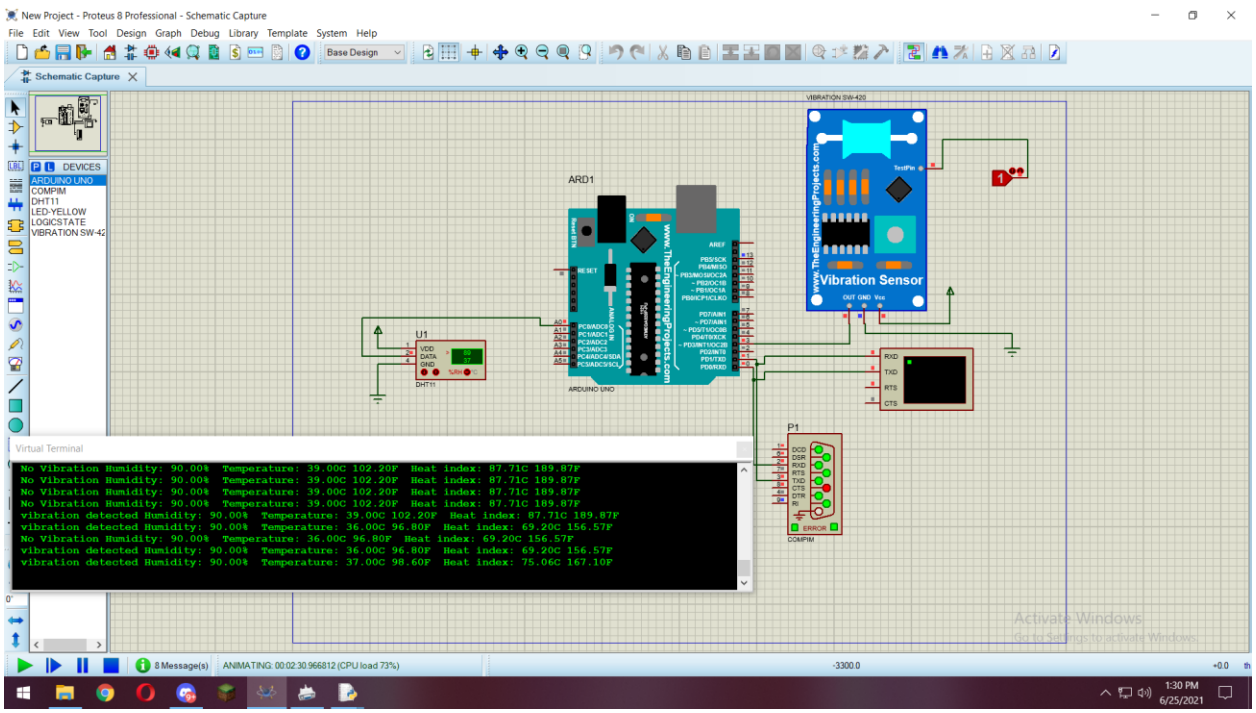


B. Data uploaded on firebase (Firebase Window)

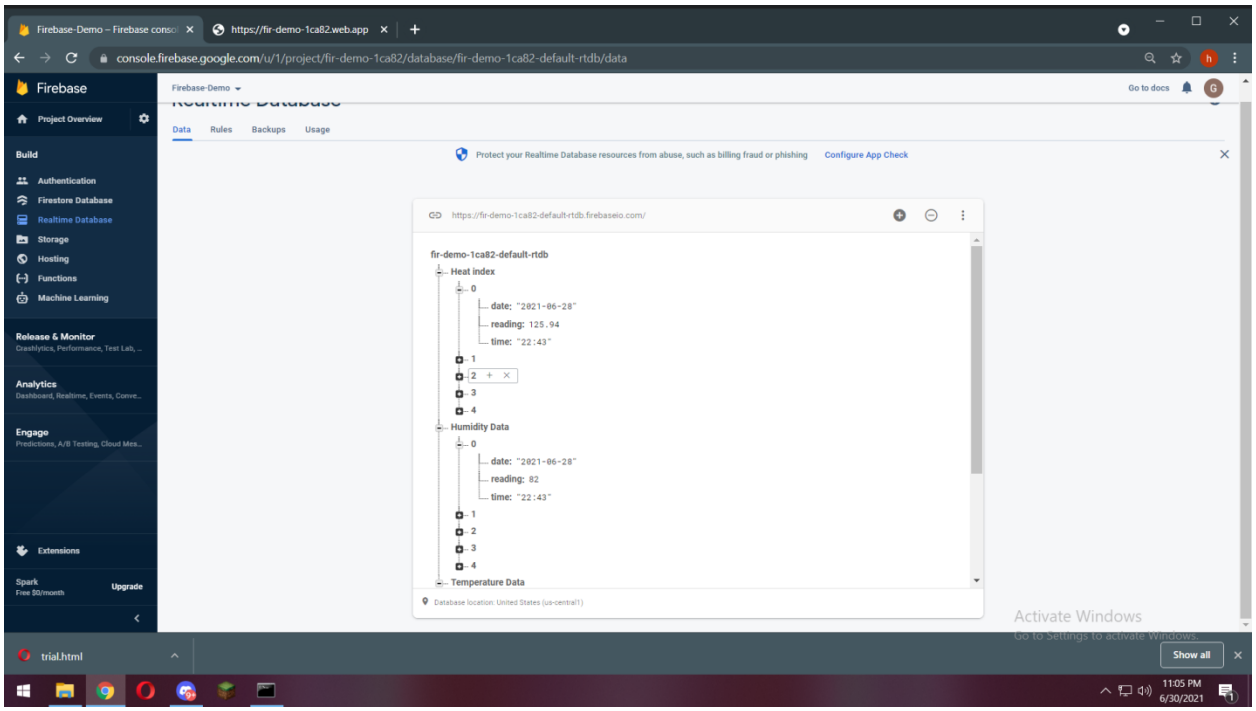




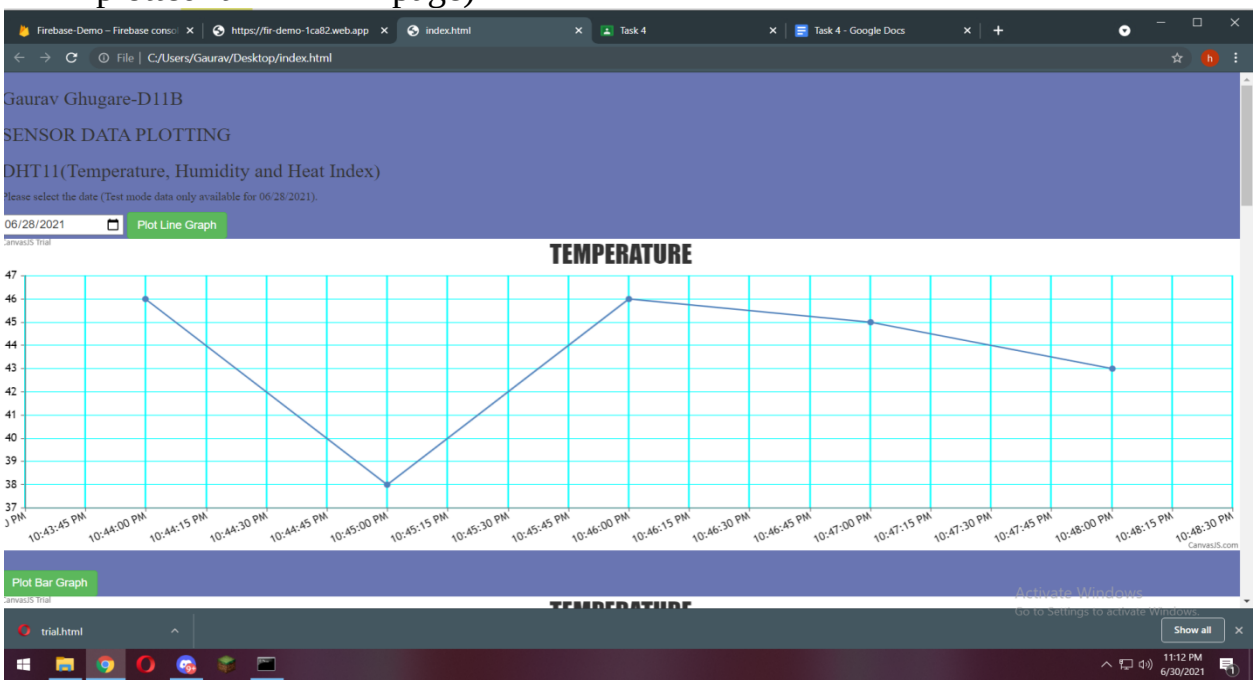
C. Screenshot of Proteus while simulation.



D. Submit the Screenshot of the Firebase real-time database(data can be of your choice).



E. Submit the screenshot of the plotted graph in the HTML page.(The website url bar and chrome should be visible in the screenshot, to prove that you plotted it in HTML page)



F. Link of deployed Webapp

https://fir-demo-1ca82.web.app/

ADVANTAGES AND DISADVANTAGES

Advantages:

1. Worldwide monitoring
2. Real-time alerts
3. Reduced wiring
4. Reduce cost
5. Easy installation
6. Easy maintenance and so on

Disadvantages:

1. Reliably detect and estimate small displacements
2. Determine column that moved
3. Estimate new locations of dislocated columns
4. Estimate location of slip surface
5. Faulty Readings

APPLICATION

1) If a landslide is noticed early enough, it is possible to avoid any accidents by relocating any human life to a safe location.
2) Roads can be closed to prevent vehicles from being caught in the debris.
3) Stay away from the slide area. There may be danger of additional slides. Listen to local radio or television stations for the latest emergency information. Watch for flooding, which may occur after a landslide or debris flow.

LEARNING OUTCOMES

1) Better Knowledge of proteus software , arduino IDE and creation of Hex File.
2) Basic Understanding of Firebase – How data gets uploaded in real-time on it.
3) Practical experience with C programming for Arduino and Python programming for data upload.
4) Designing of Web App using HTML,CSS,JAVASCRIPT.
5) Linking HTML code with firebase to retrieve data from it.
6) Hosting,creation and deployment of WebApp.

CONCLUSION

As a prototype, the landslide detection system has been successfully implemented. All of the sensors and other equipment function as expected. The sensors successfully sense and provide readings based on the surrounding conditions. The prediction of a landslide based on readings was successful. The system continuously senses and transmits data. The zone is determined by the results of the soil moisture sensor. The threshold values vary depending on the kind of soil and its properties. The accelerometer is used to monitor any soil movement caused by the

vibrations of the earth. To use the accelerometer as a seismograph, the output values are transferred to reference values.

REFERENCES

1) A. Uddin, "How to host static website on firebase hosting for free," *Medium*, 02-Dec-2018. [Online]. Available: https://medium.com/@aleemuddin13/how-to-host-static-website-on-firebase-hosting-for-free-9de8917bebf2. [Accessed: 08-Jul-2021].

2)E. F. —, "Landslide detection system using wireless sensor network based on IOT," Electronic Clinic, 02-Apr-2021. [Online]. Available: https://www.electroniclinic.com/landslide-detection-system-using-wireless-sensor-network-based-on-iot/ [Accessed: 17-Jun-2021].

3) R. Dhanagopal and B. Muthukumar, "A Model for Low Power, High Speed and Energy Efficient Early Landslide Detection System Using IoT," Wireless Personal Communications, 20-Nov-2019. [Online]. Available: https://link.springer.com/article/10.1007/s11277-019-06933-7. [Accessed: 17-Jun-2021]

4) Sikrigagan, "Creating Dynamic JavaScript Charts with Firebase," *Scotch*, 05-Apr-2019. [Online]. Available: https://scotch.io/@sikrigagan/creating-dynamic-javascript-charts-with-firebase. [Accessed: 08-Jul-2021].

5) "How to classify a landslide," *British Geological Survey*, 22-Jun-2021. [Online]. Available:https://www.bgs.ac.uk/discovering-geology/earth-hazards/landslides/how-to-classify-a-landslide/ [Accessed: 08-Jul-2021].

APPENDIX

Source code (Web App)
https://github.com/Tinkerers-Lab-VESIT-ETRX/IoT-based-landslide-prediction-and-prevention-2/blob/main/WebApp.html

Source code(Arduino code)
https://github.com/Tinkerers-Lab-VESIT-ETRX/IoT-based-landslide-prediction-and-prevention-2/blob/main/Arduino_code.ino

Source code (Python data upload)
https://github.com/Tinkerers-Lab-VESIT-ETRX/IoT-based-landslide-prediction-and-prevention-2/blob/main/Firebase%20Data%20Upload.py