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-1

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INTRODUCTION

A. Existing Problem:

Landslide is a natural disaster damaging the social life every year. It can be defined as the movement of mass of rock, debris down a slope. It occurs due to natural or manmade activities. Asia was found to be the most affected continent where 75% of landslides occurred. India also faced the loss of humans due to landslides which occurred last year during monsoon in kerala. 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: Destroys the slope/hill, eliminates all vegetation, Buries houses and sometimes entire villages, Weakens the slope and makes it more susceptible to further landslides.

B. Overview:

Landslide detection system using the Wireless Sensor Network based on the IoT "Internet of things**"**. This is quite an advanced level project capable of monitoring the earth vibration, Temperature, Humidity, and the Soil moisture. All these sensors are connected with different IoT Nodes which make the complete network. The number of nodes can be increased and decreased as per the requirement. All the Landslide detection nodes are monitored using website.

C. Purpose:

Main Purpose: To Detect Landslide at an early stage and save losses in the form of lives and livestock.

Functional Purpose: To retrieve real time readings from the Database and display the values of various sensors in the form of graph on the WebApp.

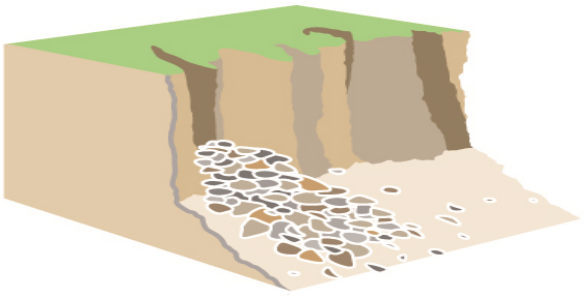
LITERATURE REVIEW

Avalanche is a cataclysmic event harming the public activity consistently. It very well may be characterized as the development of mass of rock, garbage down an incline. It occurs due to natural or manmade activities. 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 principle point of the proposed framework is to identify those conditions which prompt the event of avalanche and inform it a long time before time with the goal that important advances can be taken to lessen or save the human loss.

Types of Landslides

Rock Falls

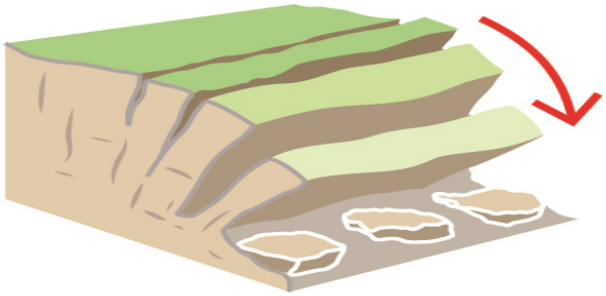
Falls are landslides that involve the collapse of material from a cliff or steep slope. Falls usually involve a mixture of free fall through the air, bouncing or rolling. A fall-type landslide results in the collection of rock or debris near the base of a slope.



Rock fall

Rock Topples

Topple failures involve the forward rotation and movement of a mass of rock, earth or debris out of a slope. This kind of slope failure generally occurs around an axis (or point) at or near the base of the block of rock.



Rock topple

Talus Cones

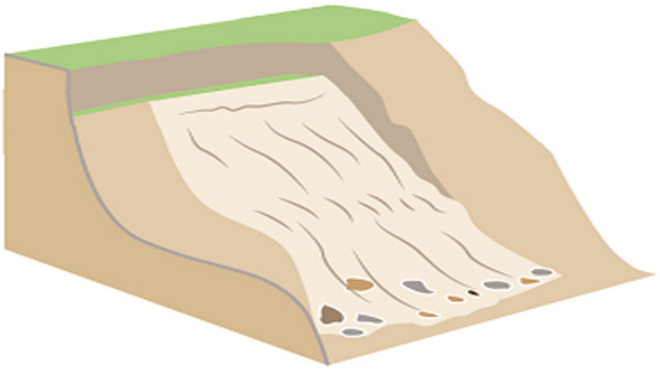
A topple often results in the formation of debris or a debris cone at the base of the slope; this pile is called a talus cone. New talus cones don't have any plants growing on them. Old talus cone can have weeds and even trees on them.

Limestone talus cone in the Allt nan Uamh, Assynt

Slides

A slide-type landslide is a downslope movement of material that occurs along a distinctive rupture or slip surface. The slip surface tends to be deeper than that of other landslide types and not structurally controlled. These landslides are characterised by a prominent main scarp and back-tilted bench or block at the top, with limited internal deformation. Below this, movement is more or less rotational about an axis. Slides are characterised by a failure of material at depth and then movement by sliding along a rupture or slip surface. There are two types of slide failure, rotational slides (slumps) and translational (planar) slides.

- **Rotational slides**
  If the slip surface is listric (curved or spoon-shaped) the slide is said to be rotational. A good example of a rotational landslide is the Holbeck Hall landslide, in Scarborough, North Yorkshire.

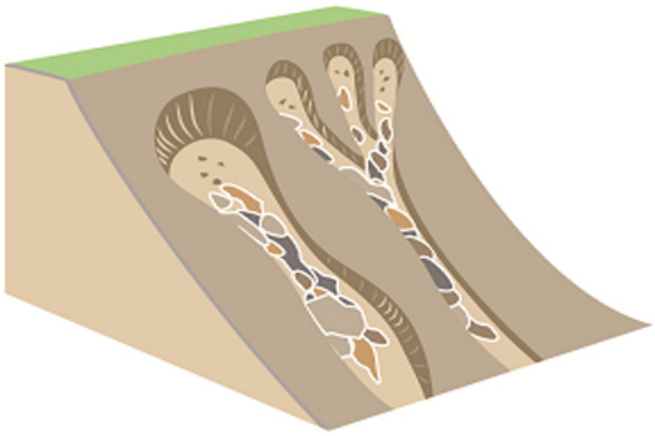


- **Translational slides**

  A translational or planar landslide is a downslope movement of material that occurs along a distinctive planar surface of weakness such as a fault, joint or bedding plane. Some of the largest and most damaging landslides on Earth are translational. These landslides occur at all scales and are not self-stabilising. They can be very rapid where discontinuities are steep.

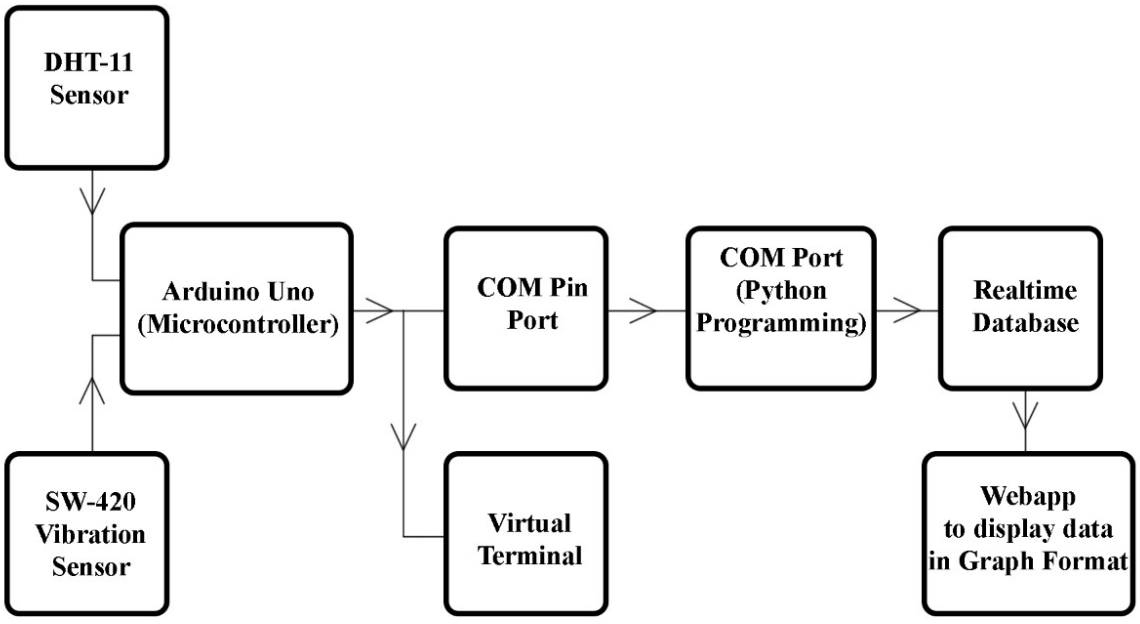
- **Flows**

  Flows are landslides that involve the movement of material down a slope in the form of a fluid. Flows often leave behind a distinctive, upside-down funnel shaped deposit where the landslide material has stopped moving. There are different types of flows: mud, debris and rock (rock avalanches).

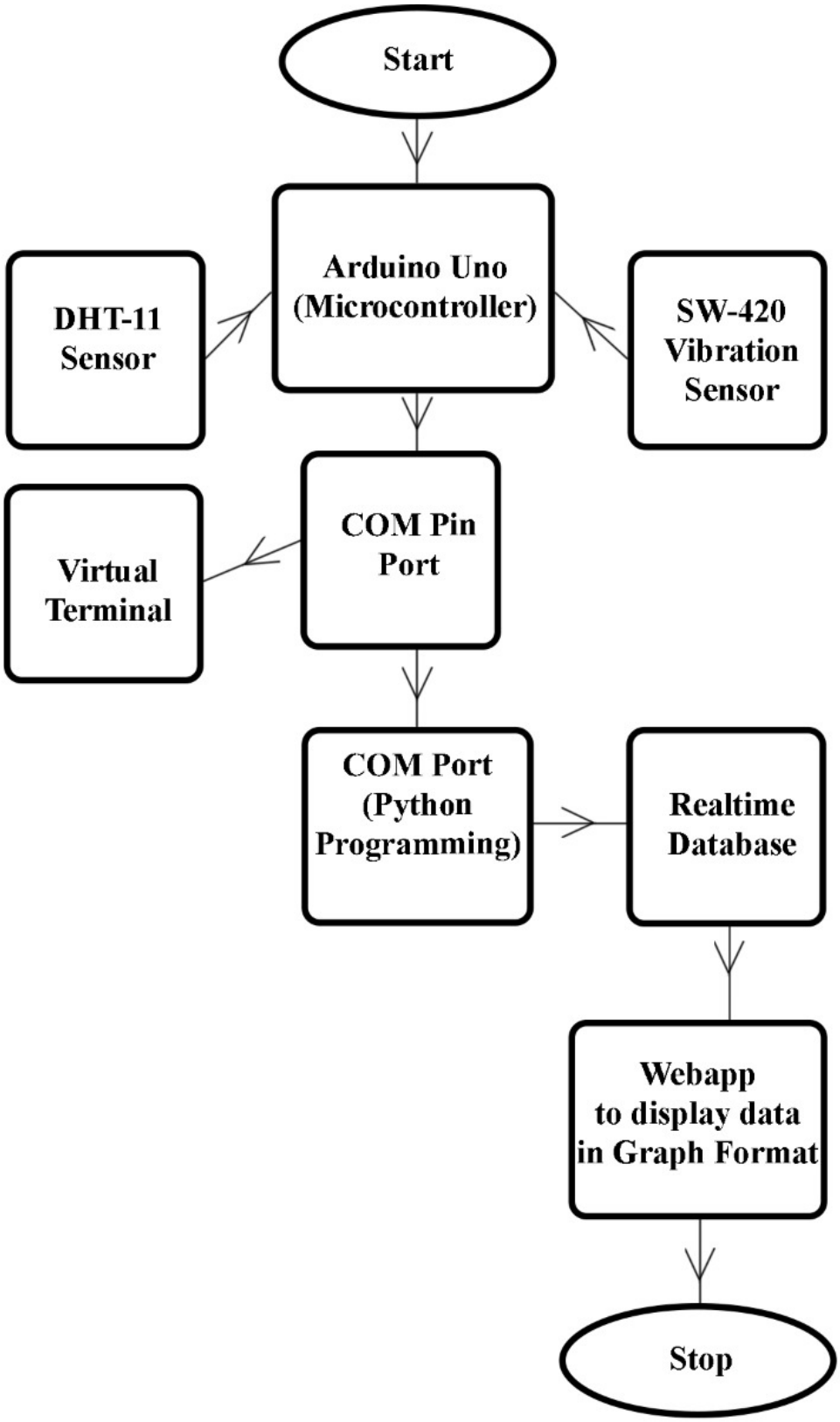


PROPOSED SOLUTION

A. BLOCK DIAGRAM

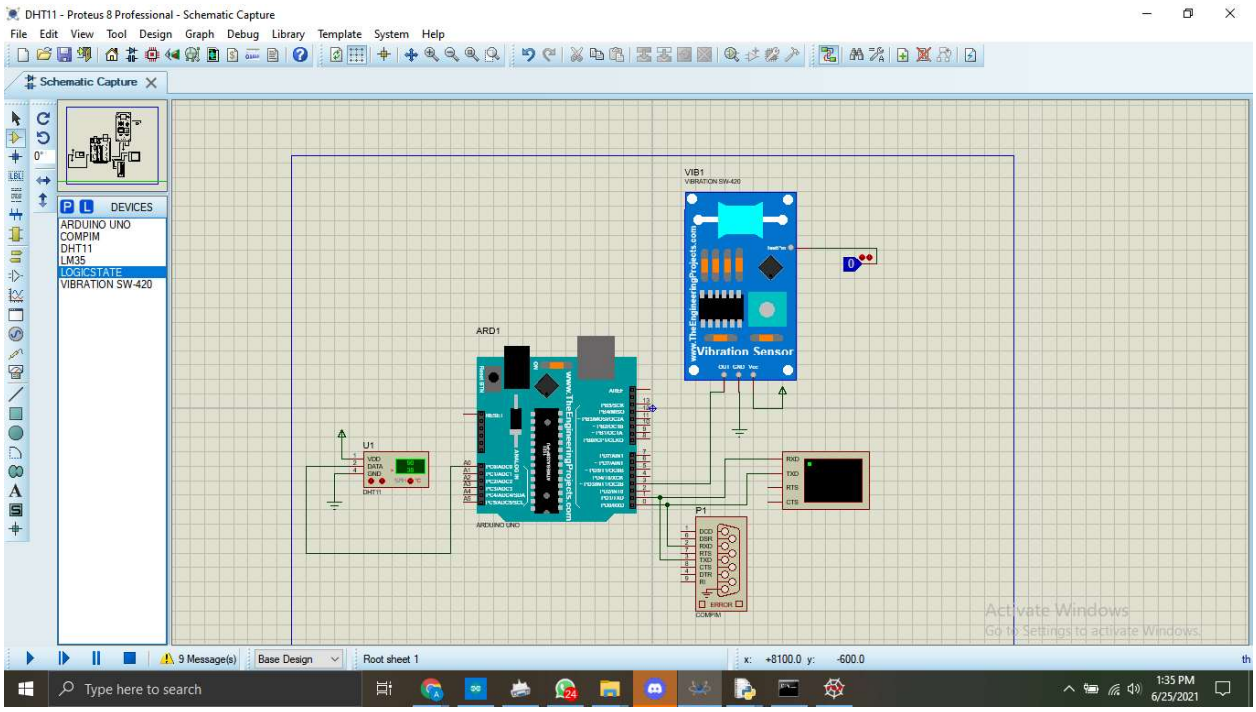


B. FLOWCHART

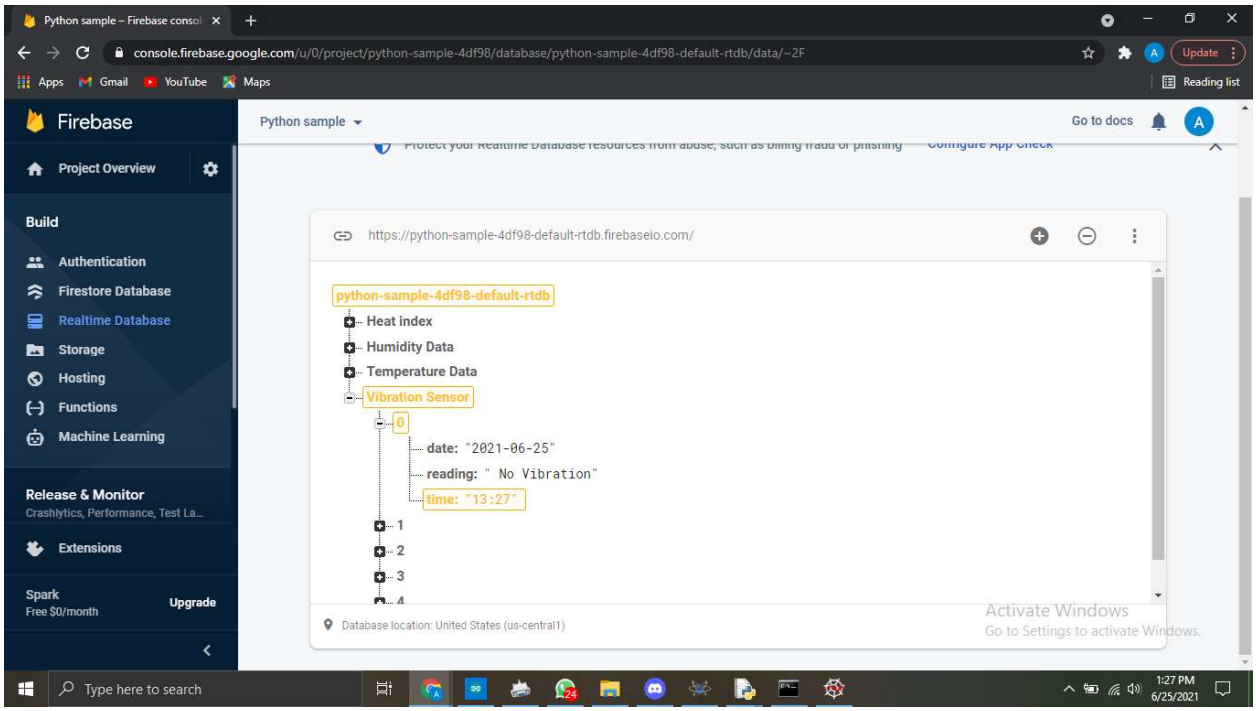

Start
Arduino Uno (Microcontroller)
DHT-11 Sensor
SW-420 Vibration Sensor
COM Pin Port
Virtual Terminal
COM Port (Python Programming)
Realtime Database
Webapp to display data in Graph Format
Stop

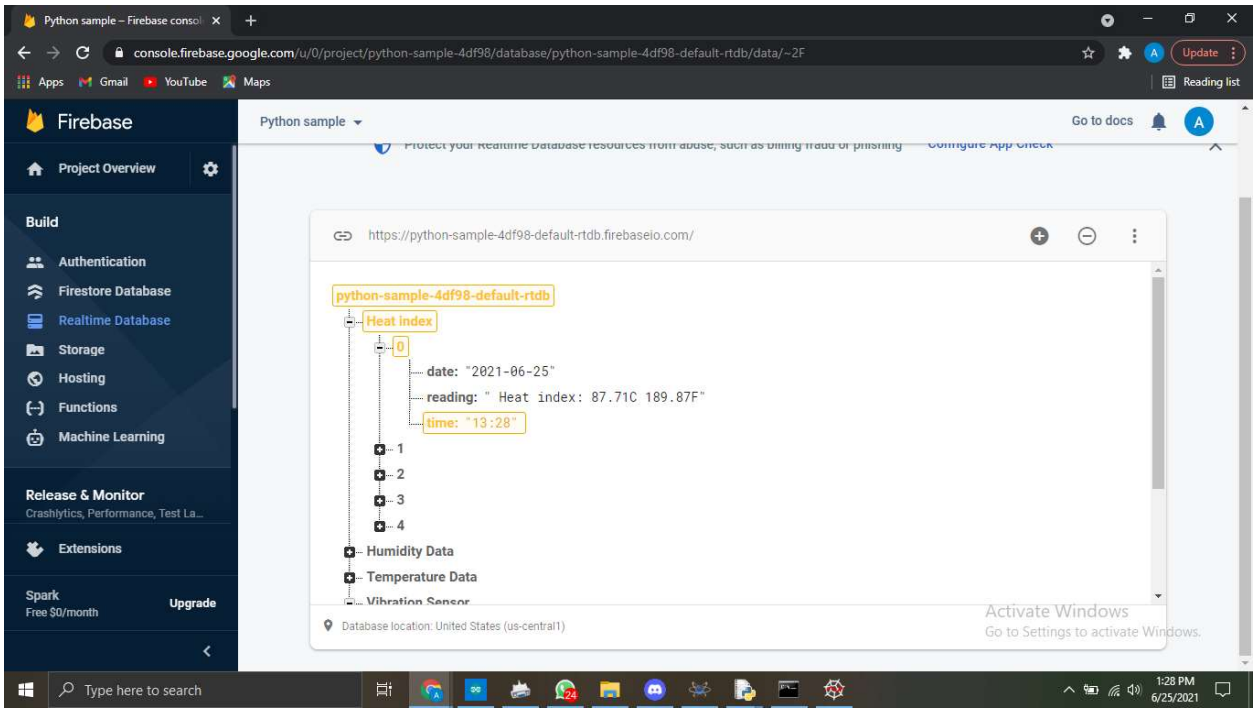
RESULT

A. Fullscreen Screenshot of proteus.

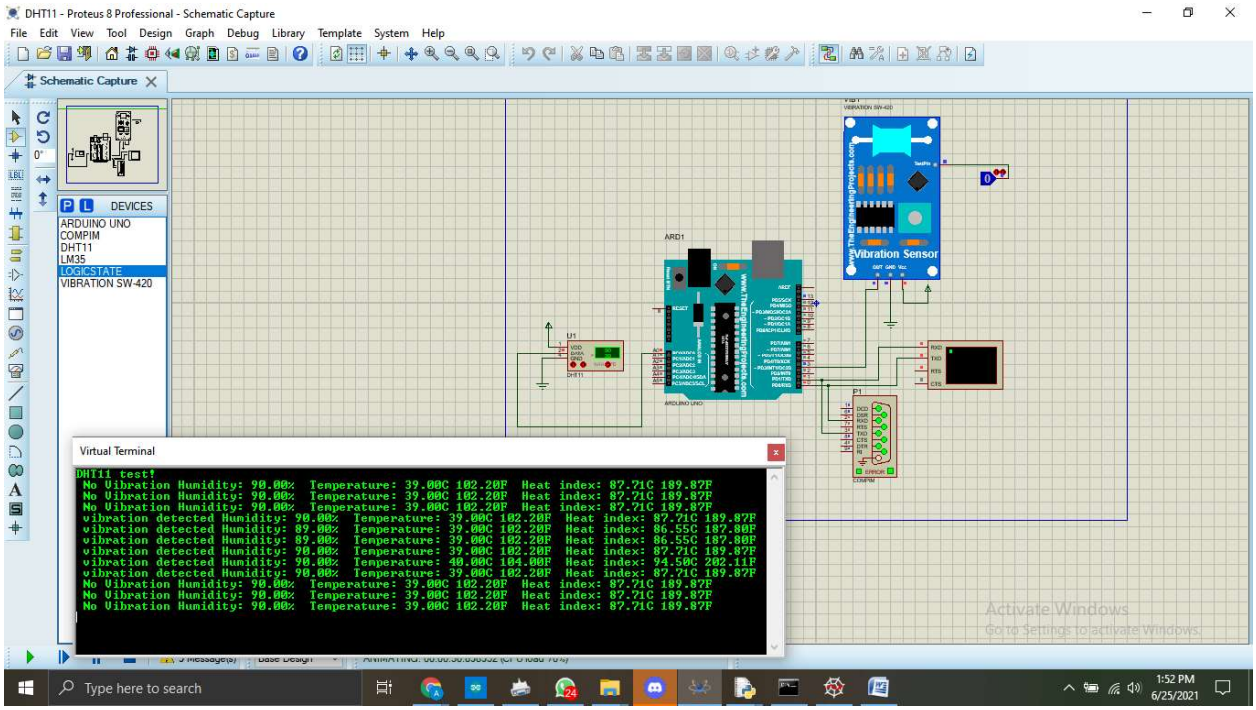


B. Data uploaded on firebase.(Firebase Window)

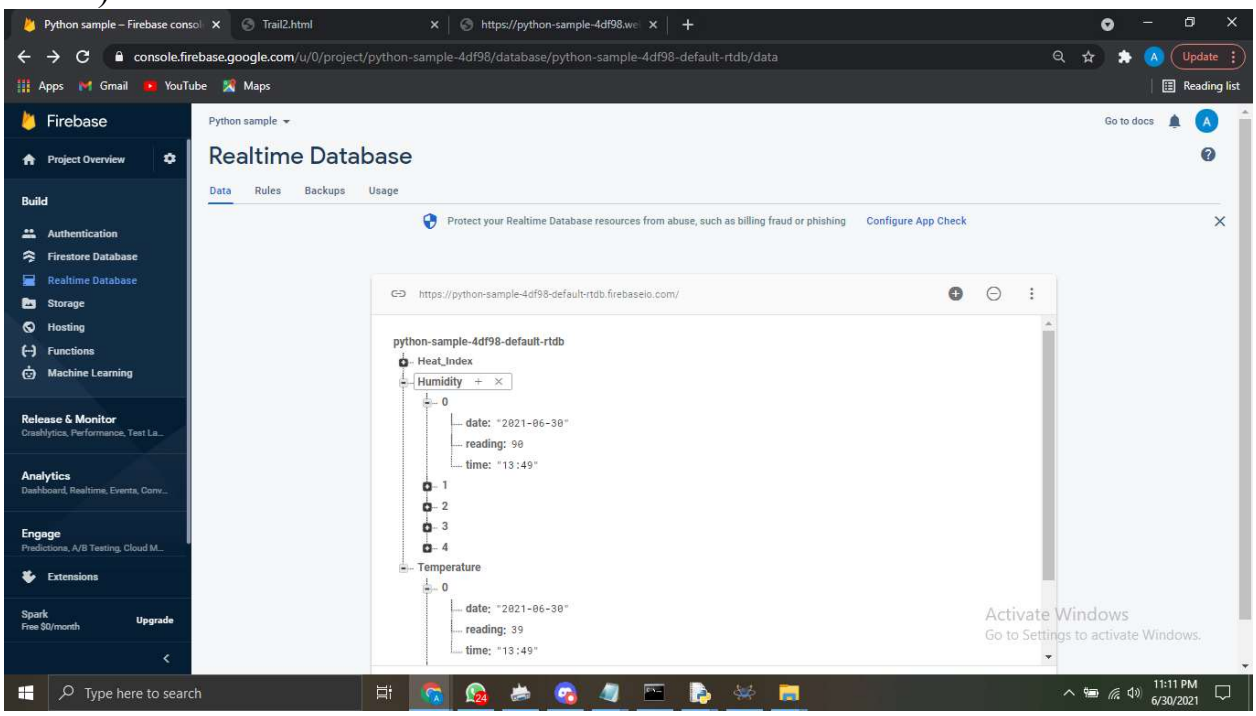

Python sample – Firebase consol
console.firebase.google.com/u/0/project/python-sample-4df98/database/python-sample-4df98-default-rtdb/data/~2F
Update
Apps
Gmail
YouTube
Maps
Reading list
Firebase
Python sample
Go to docs
Project Overview
Build
Authentication
Firestore Database
Realtime Database
Storage
Hosting
Functions
Machine Learning
Release & Monitor
Crashlytics, Performance, Test La...
Extensions
Spark
Free $0/month
Upgrade
https://python-sample-4df98-default-rtdb.firebaseio.com/
python-sample-4df98-default-rtdb
Heat index
Humidity Data
Temperature Data
Vibration Sensor
0
date: "2021-06-25"
reading: " No Vibration"
time: "13:27"
1
2
3
Database location: United States (us-central1)
Activate Windows
Go to Settings to activate Windows.
Type here to search
1:27 PM
6/25/2021


Python sample – Firebase consol
console.firebase.google.com/u/0/project/python-sample-4df98/database/python-sample-4df98-default-rtdb/data/~2F
Update
Apps
Gmail
YouTube
Maps
Reading list
Firebase
Python sample
Go to docs
Project Overview
Build
Authentication
Firestore Database
Realtime Database
Storage
Hosting
Functions
Machine Learning
Release & Monitor
Crashlytics, Performance, Test La...
Extensions
Spark
Free $0/month
Upgrade
https://python-sample-4df98-default-rtdb.firebaseio.com/
python-sample-4df98-default-rtdb
Heat index
0
date: "2021-06-25"
reading: " Heat index: 87.71C 189.87F"
time: "13:28"
1
2
3
4
Humidity Data
Temperature Data
Vibration Sensor
Database location: United States (us-central1)
Activate Windows
Go to Settings to activate Windows.
Type here to search
1:28 PM
6/25/2021

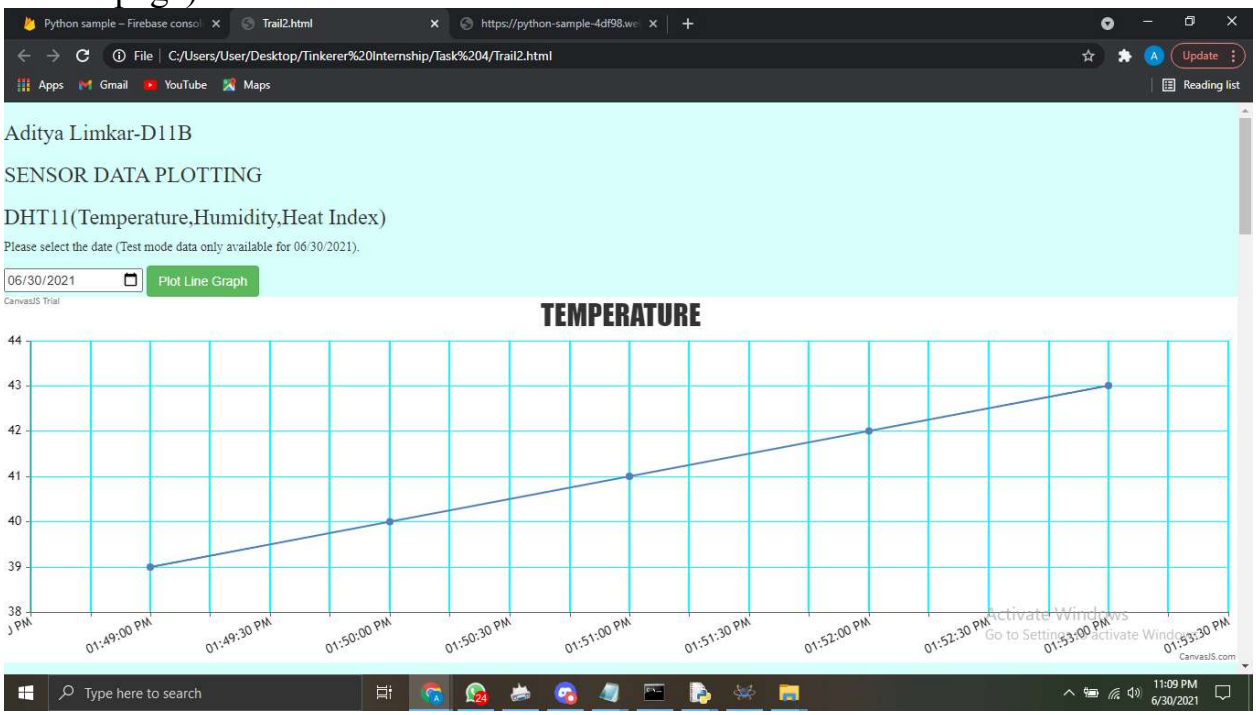
C. Screenshot of proteus while simulation.



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://python-sample-4df98.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

The landslide detection system is successfully implemented as a prototype. All the sensors and other stuff works as per the expectations. The sensors effectively sense the surrounding conditions and give the readings. Based on readings, the prediction of landslide is achieved successfully. The system senses data and transmits it continuously. The readings of Soil Moisture sensor are used to decide the zone. The threshold values change according to the soil type and its characteristics. The accelerometer is used to check any movement of soil due to earth's vibration. The output values of accelerometer are mapped with the reference values to use it as a Seismograph device.

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3) "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].

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5) 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].

APPENDIX

A. Source code (Web App)
https://github.com/Tinkerers-Lab-VESIT-ETRX/IoT-based-landslide-prediction-and-prevention-1/blob/main/WebApp.html

B. Source code(Arduino code)
https://github.com/Tinkerers-Lab-VESIT-ETRX/IoT-based-landslide-prediction-and-prevention-1/blob/main/ArduinoCode.ino

C. Source code (Python data upload)
https://github.com/Tinkerers-Lab-VESIT-ETRX/IoT-based-landslide-prediction-and-prevention-1/blob/main/Data%20Uploading.py