# DESIGN AND DEVELOPMENT OF EARTHQUAKE DETECTION SYSTEM

**A**

## PROJECT REPORT

Submitted in partial fulfilment of the requirements

for the degree of

**BACHELOR OF TECHNOLOGY**

in

**COMPUTER SCIENCE & ENGINEERING**

By

**GROUP NO.47**


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Under the guidance of

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**Dec-2020**


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**An ISO 9001:2008 Certified Institution**
**Approved by AICTE, New Delhi & Govt. of M.P.**
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*Sagar Institute of Science & Technology (SISTec), Bhopal*

***Department of COMPUTER SCIENCE & ENGINEERING***
***Bhopal (M.P.)***

***DEC-2020***

## ***CERTIFICATE***

I hereby certify that the work which is being presented in the B.Tech. Minor Project-I entitled **Design and Development of Earthquake Detection System,** in partial fulfilment of the requirements for the award of the degree of **Bachelor of Engineering Computer Science & Engineering** and submitted to the Department of Computer Science & Engineering, Sagar Institute of Science & Technology (SISTec**),** Bhopal (M.P.) is an authentic record of my own work carried out during the period from Jul-2020 to Dec-2020 under the supervision of **Prof. Rajesh Rai, Assistant Professor.**

The content presented in this project has not been submitted by me for the award of any other degree elsewhere.

**Signature**

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This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

**Date*:***

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# ABSTRACT

Development of the Internet of things (IoT) is considered as one of the major events in modern day industrial revolution. Digital transformation has become inevitable for majority of organizations wanting to achieve better productivity and management of processes and assets.
With applications in healthcare, home automation, and building and construction, IoT has become ubiquitous. The major challenge for manufacturers is to develop smooth communications to enhance capacity and flexibility of actuators, analyzers, and robotics. IoT-enabled industrial automation can offer integration of various commercial technologies across major industrial applications, such as with programmable logic controllers.

As we all know that the Internet of things (**IoT**) is a system of interrelated computing devices, mechanical and digital machines provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. Earthquake early-warning systems detect the first quivering of a major quake, triggering alarm systems in advance of the most violent shaking. . The alerts would allow businesses, residents, and public agencies time to get ready. The purpose of the study focuses on the sensor data to decide if an earthquake is occurring. Finally, experimental results are provided showing that the system will support the expected performance with the sensor data. A possible extension of the approach could be implementing one wireless sensor networks using firebase for data acquisition. This data in real-time can be used to send the alerts on android devices and websites.
This project is based on making an IoT device for the measuring of the seismic activity. This data in real-time will be pushed to the Firebase cloud. This cloud will help us in showing the real-time analytics of the seismic motion. This data then will be fetched for the android and web-based applications. These applications would be user friendly and help as an alert for the earthquake.
This whole ecosystem is also complemented by the dashboard for the evaluation of the seismic waves.

# ACKNOWLEDGEMENT

No Volume of words is enough to express my gratitude towards my guide **Prof. Rajesh Rai,** Assistant professor and my project coordinator **Prof. Vipin Verma**, Department of Computer Science and Engineering, who has been very concerned and has added all the material essential for the preparation of this project report. I wish to express my sincere gratitude to **Dr. Swati Saxena**, Vice-principal and **Prof. Ujjwal Nigam**, Head of Department for providing us an opportunity to do our project work on **"Design and Development of Earthquake Detection System".** This project bears the imprint of many people.

I would also like to thank the staff members and my colleagues who were always there for the need of the hour and provided with all the help and facilities, which I required, for the completion of the project work.

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## LIST OF FIGURES

# LIST OF ABBREVIATIONS

| ACRONYM | FULL FORM |
|---|---|
| SDLC | Software Development Life Cycle |
| IoT | Internet Of Things |
| SQL | Structured Query Language |
| HTML | Hyper Text Markup Language |
| UML | Unified Modeling Language |
| E-R | Entity Relation |

# CHAPTER-1
# INTRODUCTION

## 1.1 INTRODUCTION

The Internet of things (IoT) is a system of interrelated computing devices, mechanical and digital machines provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

Industrial IoT must be self-organizing, self-configuring, self-healing, scalable to large sizes, with very low energy consumption, low cost, simple to install and based on global standards.

Development of the Internet of things (IoT) is considered as one of the major events in modern day industrial revolution. Digital transformation has become inevitable for majority of organizations wanting to achieve better productivity and management of processes and assets.

With applications in healthcare, home automation, and building and construction, IoT has become ubiquitous. The major challenge for manufacturers is to develop smooth communications to enhance capacity and flexibility of actuators, analyzers, and robotics. IoT-enabled industrial automation can offer integration of various commercial technologies across major industrial applications, such as with programmable logic controllers.

## 1.2 ABOUT PROJECT: -

As we all know that the Internet of things (**IoT**) is a system of interrelated computing devices, mechanical and digital machines provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. Earthquake early-warning systems detect the first quivering of a major quake, triggering alarm systems in advance of the most violent shaking. . The alerts would allow businesses, residents, and public agencies time to get ready. The purpose of the study focuses on the sensor data to decide if an earthquake is occurring. Finally, experimental results are provided showing that the system will support the expected performance with the sensor data. A possible extension of the approach could be implementing one wireless sensor networks using set of sensors for data acquisition. This data in real-time can be used to send the alerts on android devices and websites

## 1.3 PROJECT OBJECTIVES: -

Our main objectives to develop this project are as follows:-

- To make earthquake detection system.
- To develop an EEW model which is cost effective and reliable system.
- To develop a mobile application for the alert system.

# CHAPTER-2
# SOFTWARE AND HARDWARE REQUIREMENT

## SOFTWARE: -

IoT software addresses its key areas of networking and action through platforms, embedded systems, partner systems, and middle ware. These individual and master applications are responsible for data collection, device integration, real-time analytics, and application and process extension within the IoT network. They exploit integration with critical business systems (e.g., ordering systems, robotics, scheduling, and more) in the execution of related tasks.

Software Requirement Specifications: -

- Arduino
- Android Studio
- Arduino IDE

## HARDWARE: -

The hardware utilized in IoT systems includes devices for a remote dashboard, devices for control, servers, a routing or bridge device, and sensors. These devices manage key tasks and functions such as system activation, action specifications, security, communication, and detection to support-specific goals and actions.

Hardware Requirement Specifications:

- ESP 8266
- ADLX 345 sensor
- Bread board

# CHAPTER-3
# PROBLEM DISCRIPTION

## 3.1 PROBLEM STATEMENT

In the recent time the frequent earthquakes are one of the major cause of the natural calamity. The earthquake's not only cause damage to the property but also to the human lives. As said "prevention is better than the cause" an early warning pf the earthquake shockwave can saves thousands of life . Earthquake early-warning systems detect the first quivering of a major quake, triggering alarm systems in advance of the most violent shaking. . The alerts would allow businesses, residents, and public agencies time to get ready. The purpose of the study focuses on the sensor data to decide if an earthquake is occurring. Finally, experimental results are provided showing that the system will support the expected performance with the sensor data. A possible extension of the approach could be implementing one wireless sensor networks using thinkspeak for data acquisition. This data in realtime can be used to send the alerts on android devices and websites

### 3.2 SOLUTION OF ABOVE PROBLEM

To tackle this problems faced by people in day to day life, we are trying to make digital solution which include cutting edge technologies like Internet of Things (IoT) and mobile application development for minimizing human efforts.

So to get rid out of this situation we have decided to make an application which can control the various appliances in just one touch or click of our hand.

Through this project we are trying to do automation with the help of IOT and its theory with the help of its Platform and its various equipment or tools like Audino, Node-MCU, ADLX345. The set of collective sensors will create an ecosystem for sensing of the seismic waves. When the collective set of the device goes through the same kind of displacements in the axis the prediction regarding the earthquake seismic waves can be done.

In our project we are using android application too to control the various appliances through that app. Its get easy through app to control the various appliances in just one touch from anywhere with the help of internet and router which enable us to control the various appliances from far places too.

# CHAPTER-4
# LITERATURE SURVEY

## 4.1 LITERATURE REVIEW

The Internet of things (IoT) is a system of interrelated computing devices, mechanical and digital machines provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

Industrial IoT must be self-organizing, self-configuring, self-healing, scalable to large sizes, with very low energy consumption, low cost, simple to install and based on global standards.

The experience of the earthquake in some areas has provided thousands of lives and properties, so its necessary to measures of mitigation to reduce the earthquake risk. In short time when the earthquake happens, can be used to provide early warning to the community through the development of early warning system based on the arrival of the P wave, the first wave that arrives before the real earthquake happens (S wave).

An earthquake early warning is personalized in alarm and running text that executed on a sensor system. Preparedness and speed of response are necessary because of narrow time from passing information to alleged actual of arrival earthquake. The earlier information given, the more loose the time for the population to respond. Currently, Indonesia has seismograph earthquake sensors. Seismograph has sensitive instruments that can detect seismic waves generated by earthquakes. Seismic waves that occurred during the earthquake displayed as a wavy line on the seismogram. With the evolution of IC technology, many microcontroller are produced. The microcontroller is equipped with internal memory blocks, accumulator, ALU, RAM, I/O ports and interrupt ports that support package as a medium for reading, processing and writing data from and to other components, so there are some microcontroller-based sensor systems being made with the more complete working principle1 . One of a circuit integrated developed with microcontroller is Arduino. 2 There are three types of accelerometers: a single axis acceleration to detect movement of an object in one direction,

2-axis acceleration to detect object motion in 2- directions and 3-axis acceleration to detect motion 3-directions.

## 4.2 Conclusion

This presents a detailed survey on the tools and techniques will be helpful in the monitoring and sensing of the seismic waves with the help of the IoT device and mobile application. Also this data will be available on the web based dashboard that will also allow us for the prediction of the data using the official data set from the portal of the Government of India's Earth quake live portal that run's throughout the year for the calibration of the seismic waves.

# CHAPTER-5
# HARDWARE REQUIREMENT SPECIFICATION

## 5.1 HARDWARE REQUIREMENT SPECIFICATION

The hardware utilized in IoT systems includes devices for a remote dashboard, devices for control, servers, a routing or bridge device, and sensors. These devices manage key tasks and functions such as system activation, action specifications, security, communication, and detection to support-specific goals and actions.

Hardware Requirement Specifications:

- ESP 8266
- ADL345

### 5.1.1 ESP8266

NodeMCU is an open-source firmware and development kit that helps you to prototype or builds IoT products. It includes firmware that runs on the ESP8266. The firmware uses the Lua scripting language. The ESP8285 is an ESP8266 with 1 MiB of built-in flash, allowing the building of single-chip devices capable of connecting to Wi-Fi.

The chip first came to the attention of Western makers in August 2014 with the ESP-01 module, made by a third-party manufacturer Ai-Thinker. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using Hayes-style commands. However, at first there was almost no English-language documentation on the chip and the commands it accepted. The very low price and the fact that there were very few external components on the module, which suggested that it could eventually be very inexpensive in volume, attracted many hackers to explore the module, the chip, and the software on it, as well as to translate the Chinese documentation.


**Fig 5.1:ESP8266**

## 5.1.2 ADLX 345 Sensor

The ADXL345 is a small, thin, ultralow power, 3-axis accelerometer with high resolution (13-bit) measurement at up to ±16 g. Digital output data is formatted as 16-bit twos complement and is accessible through either a SPI (3- or 4-wire) or I2C digital interface. The ADXL345 is well suited for mobile device applications. It measures the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion or shock. Its high resolution (3.9 mg/LSB) enables measurement of inclination changes less than 1.0°. Several special sensing functions are provided. Activity and inactivity sensing detect the presence or lack of motion by comparing the acceleration on any axis with user-set thresholds. Tap sensing detects single and double taps in any direction. Freefall sensing detects if the device is falling. These functions can be mapped individually to either of two interrupt output pins. An integrated memory management system with a 32-level first in, first out (FIFO) buffer can be used to store data to minimize host processor activity and lower overall system power consumption. Low power modes enable intelligent motion-based power management with threshold sensing and active acceleration measurement at extremely low power dissipation. The ADXL345 is supplied in a small, thin, 3 mm × 5 mm × 1 mm, 14-lead, plastic package.

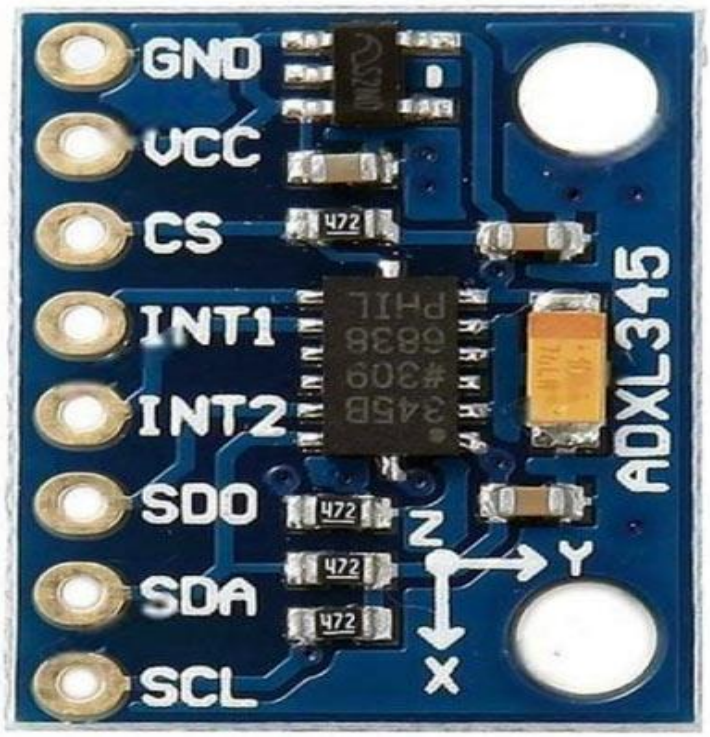



**Fig 5.2 ADLX345 Sensor**

# CHAPTER-6
# SOFTWARE REQUIREMENT SPECIFICATION

## 6.1INTRODUCTION

A software requirements specification (SRS) is a document that captures complete description about how the system is expected to perform. The software requirements specification lays out functional and non-functional requirements, and it may include a set of use cases that describe user interactions that the software must provide to the user for perfect interaction. Software requirements specification establishes the basis for an agreement between customers and contractors or suppliers on how the software product should function (in a market-driven project, these roles may be played by the marketing and development divisions). Software requirements specification is a rigorous assessment of requirements before the more specific system design stages, and its goal is to reduce later redesign. It should also provide a realistic basis for estimating product costs, risks, and schedules. Used appropriately, software requirements specifications can help prevent software project failure.

## Characteristics of SRS:

- **Correct** - An SRS is correct if, and only if, every requirement stated therein is one that the software shall meet. Traceability makes this procedure easier and less prone to error.

**Unambiguous** - An SRS is unambiguous if, and only if, every requirement stated therein has only one interpretation. As a minimum, this requires that each characteristic of the final product be described using a single unique term.

- **Verifiable** – It is verifiable if there exists some finite cost-effective process with which a person or machine check whether software product meets requirements

- **Consistent** - Consistency refers to internal consistency. If an SRS does not agree with some higher-level document, such as a system requirements specification, then it is not correct. An SRS is internally consistent if, and only if, no subset of individual requirements described in it conflict.

- **Modifiable** – SRS is said to be modifiable if its structure and style are such that any changes to the requirements can be made easily, completely and consistently while retaining the structure and style.

- **Traceable** – SRS is said to be traceable if the origin of each of its requirements is clear and it facilitates the referencing of each requirement in future enhancement.
- **Ranked for importance or stability** – SRS is ranked for importance or stability if each requirement in it has an identifier to indicate either the importance or stability of that particular requirement.

## 6.2 FUNCTIONAL REQUIREMENT

A functional requirement defines a function of a system or its component, where a function is described as a specification of behaviorur between outputs and inputs. Functional requirements are supported by non-functional requirements (also known as "quality requirements"), which impose constraints on the design or implementation (such as performance requirements, security, or reliability).

**IOT panel contain:**

**Connectivity View:** Users can use remote as a tool for controlling the various equipment's of environment which is automated with the help of relay module and uses LAN as network.

**Application View:** Users can use the ESP8266, ADLX345 for the detection of the seismic waves which is a 9 axis accelerometer . Users can use the OLED for displaying any readings which we want.

**Android App panel :**

User View: The user can get the information regarding the earthquake warning

which is automated through ESP8266 and ADLX345 sensor and uses WAN as a network.

## 6.3NON-FUNCTIONALREQUIREMENT

A non-functional requirement (NFR) is a requirement that specifies criteria that can be used to judge the operation of a system, rather than specific behaviours. They are contrasted with functional requirements that define specific behaviour or functions. The plan for

implementing functional requirements is detailed in the system design. The plan for implementing non-functional requirements is detailed in the system architecture, because they are usually architecturally significant requirements.

Performance: application will run smoothly effectively with the help of android studio and the appliances will act according to action performed by users.

Cost: application cost is not too expensive, so that one can use it freely and effectively.

6.3.1 Adaptability: This software is adaptable by any organization.

6.3.2 Availability: The availability of the software is easy and for everyone.

6.3.3 Correctness: The results of the function are pure and accurate.

6.3.4 Flexibility: The operation may be flexible and reports can be presented in many ways.

6.3.5 Maintainability: After the deployment of the project if any error occurs then it can be easily maintaining by the software developer.

6.3.6 Portability: The software can be deployed at any machine.

6.3.7 Reliability: The performance of the software is better which will increase the reliability of the software.

6.3.8 Reusability: The data and record that are saved in the database can be reused if needed.

6.3.9 Robustness: If there is any error in any window or module then it does not affect the remaining part of the software.

6.3.10 Testability: The software will be tested at every. Alpha Testing Beta Testing Acceptance Testing.

6.3.11 Usability: To perform any operations and to understand the functioning of software is very easy

# CHAPTER-7
# HARDWARE DESIGN SPECIFICATION

## 7.1 INTRODUCTION

The Hardware Design Specification is a description of the hardware on which the software resides and how it is to be connected to any existing system or plant equipment. The hardware design part must include the following items:

- Architecture
- CircuitDiagram
- PinDiagram

## 7.2Architecture

Architecture is like a base to any project as we can make our project by making architecture of the project. Its a beam of the project through which not any project get its path for working and also we will be unable to show and demonstrate the various functions and activity of the equipments.

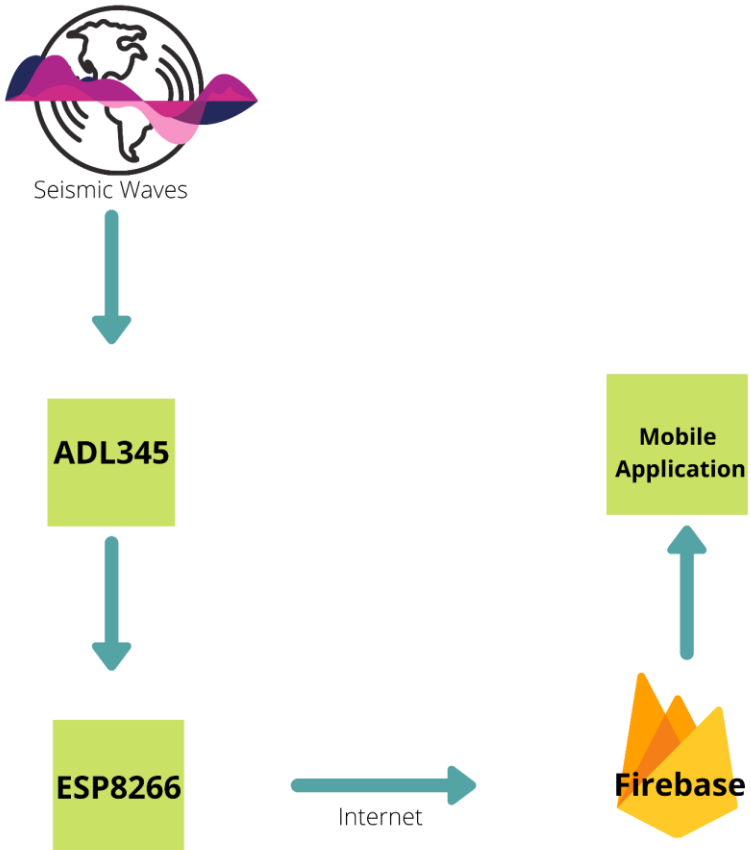





**Fig7.1 Architecture**

## 7.3 Pin Diagram

Pin diagram shows the functi0nalities of the equipments used in IOT and their internal activity through coding.

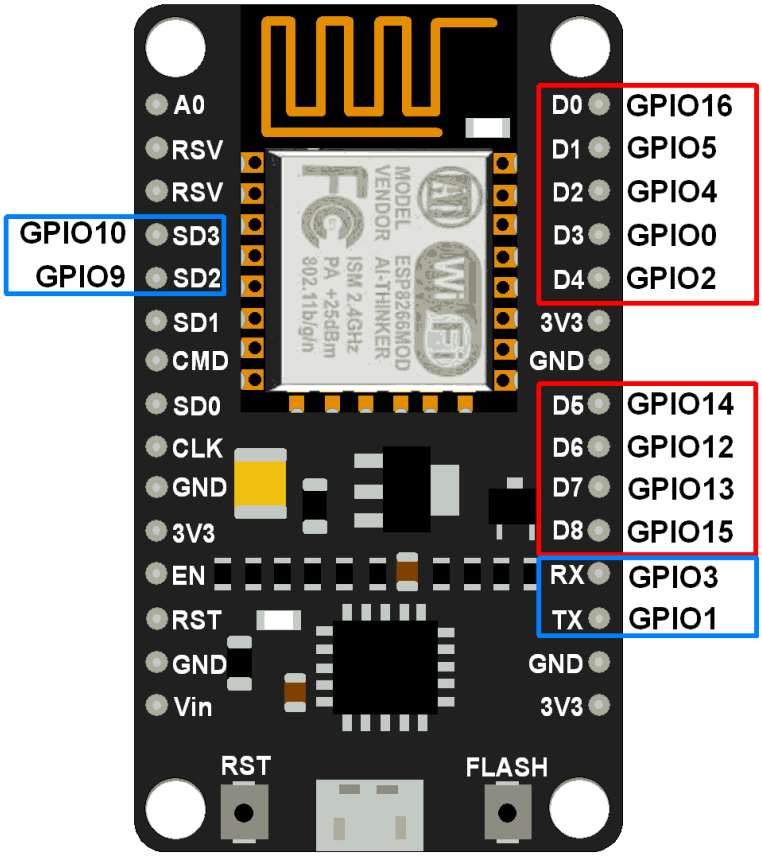



**Fig 7.2 Pin Diagram(micro-controller)**

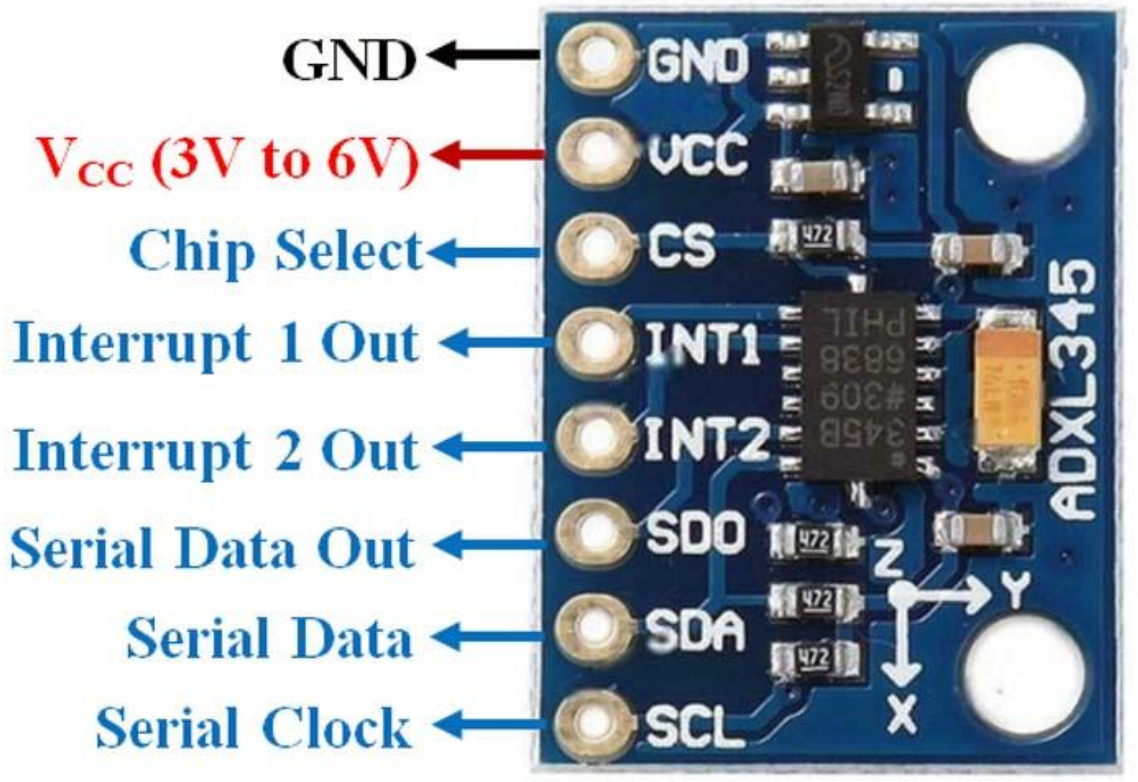
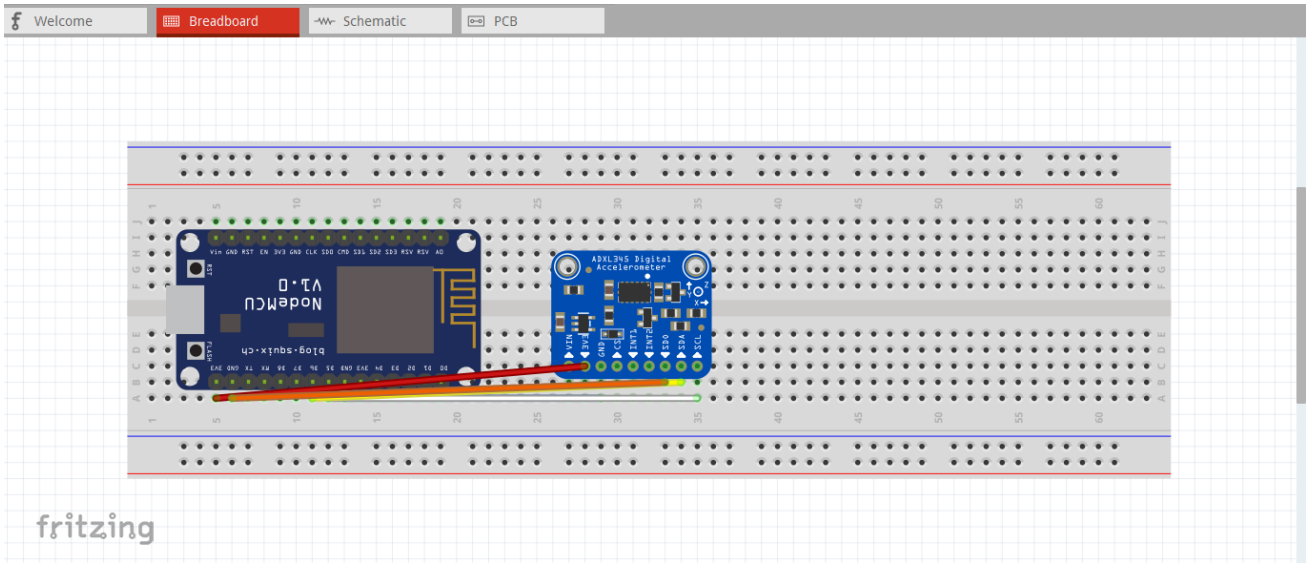



**Fig Pin diagram of the ADLX345 sensor**



# CHAPTER-8
# SOFTWARE DESIGN

## 8.1 USE CASE DIAGRAM

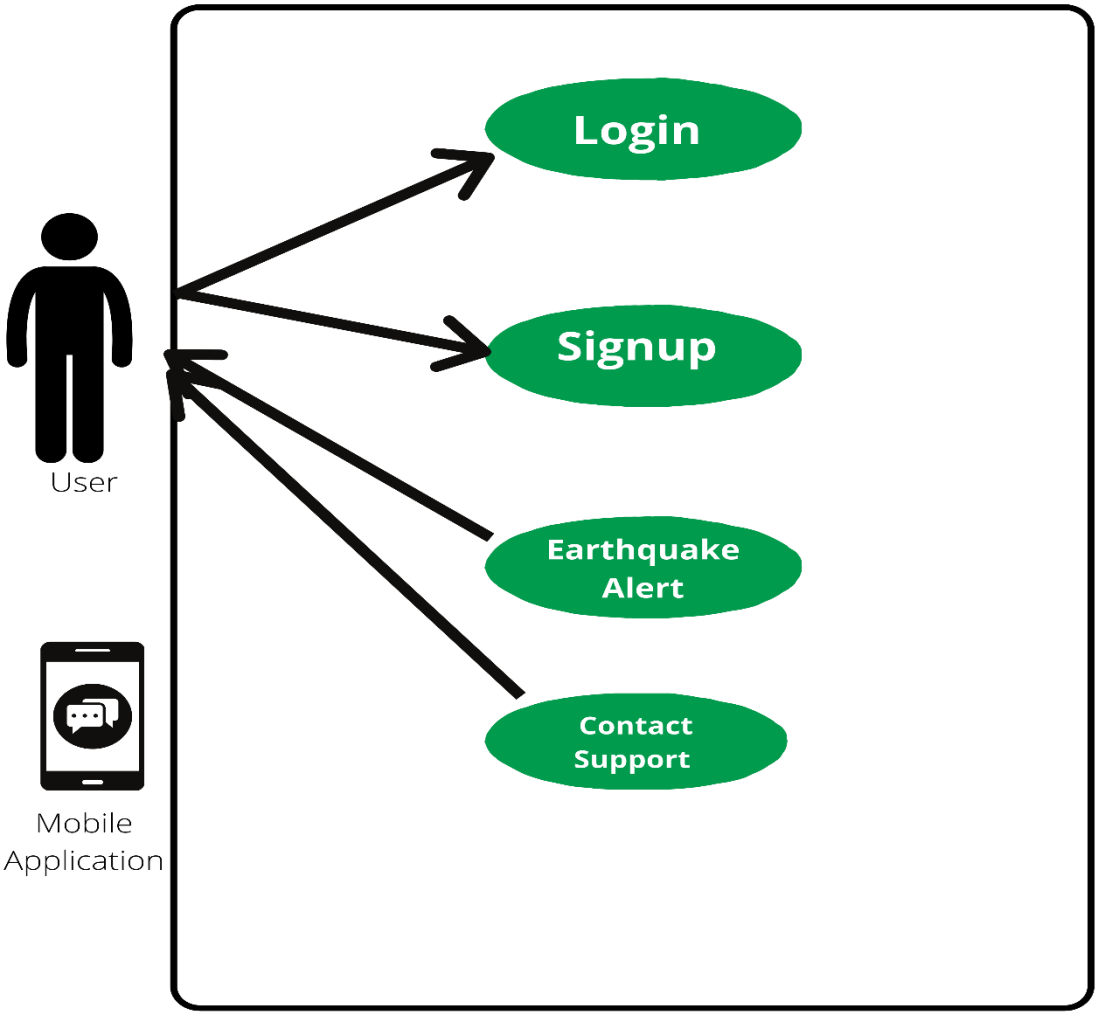
### 8.1.1 INTRODUCTION

- The use case model for any system consists of a set of use cases.
- The use cases represent the different ways in which a system can be used by the users.
- The use cases correspond to the high-level functional requirements.
- The use cases partition the system behaviorur into transactions, such that each transaction performs some useful action from the user's point of view. Each transaction to complete, may involve multiple message exchanges between the user and the system. A simple way to find all the use cases of a system is to ask the question "What all can the user does by using the system?"

### 8.1.2 REPRESENTATION OF USECASES

- A use case model is documented by drawing a use case diagram and writing an accompanying text elaborating the drawing.
- Each use case is represented by an ellipse.
- The name of the use case is written inside the ellipse.
- The use cases should be named from the users "perspective.
- All the ellipses (i.e. use cases) of a system are enclosed within a rectangle which represents the system boundary.
- The name of the system being modelled appears inside the rectangle.
- Actor: An actor is a role played by a user with respect to the system use.

**Fig 8.1 Use Case Diagram**



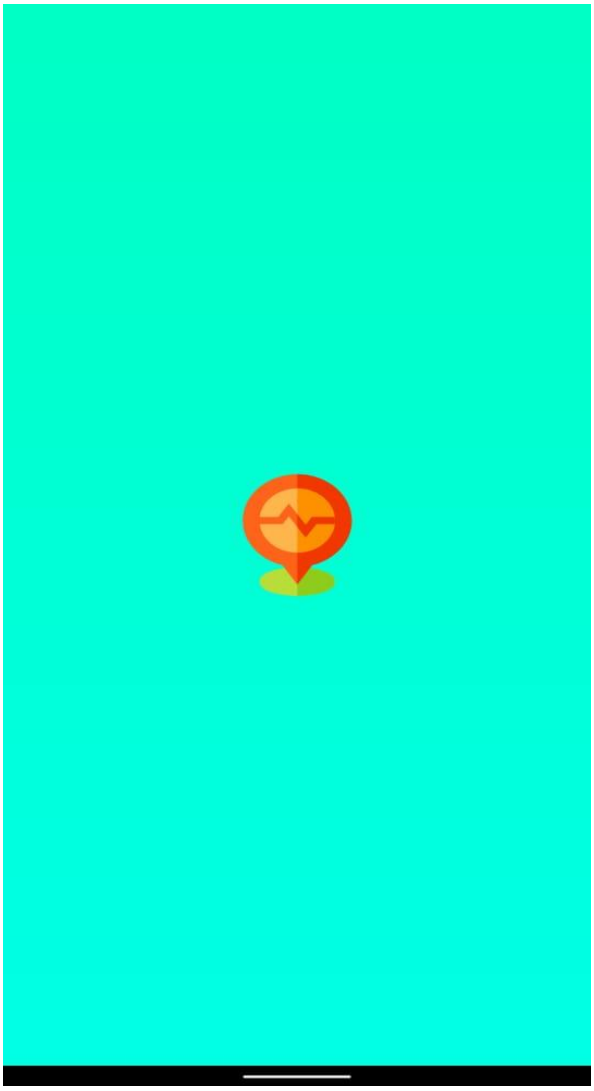
# CHAPTER-9
# RESULT AND OUTPUT SCREEN

## 9.1 Output Screen

### Android application

### 9.1.1

### Landing Page



### 9.1.1 Login and signup page

Through Login user have to login as we have use dummy data for user as there is no need to get the data stored in database. So user directly login with the dummy data and password and use the application effectively.

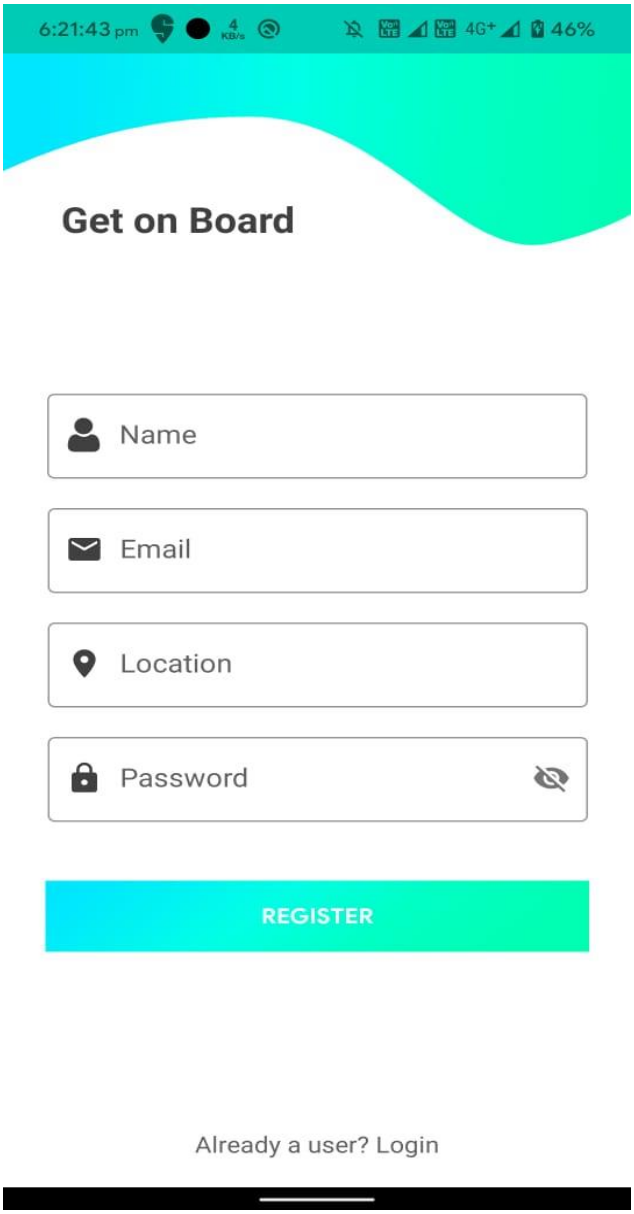



**Fig 9.1 Login Page**

### 9.1.3 Alert Page

After login user can redirect to the home page, where user can see the various buttons for the various equipments which we want to automate or which get automated through IOT.

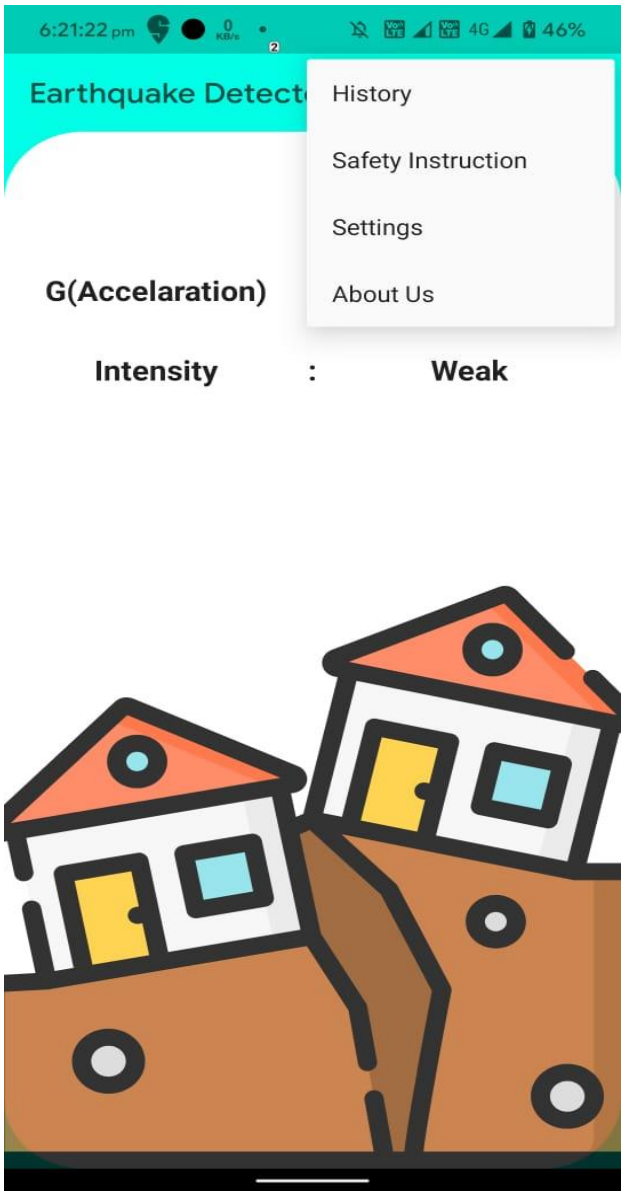
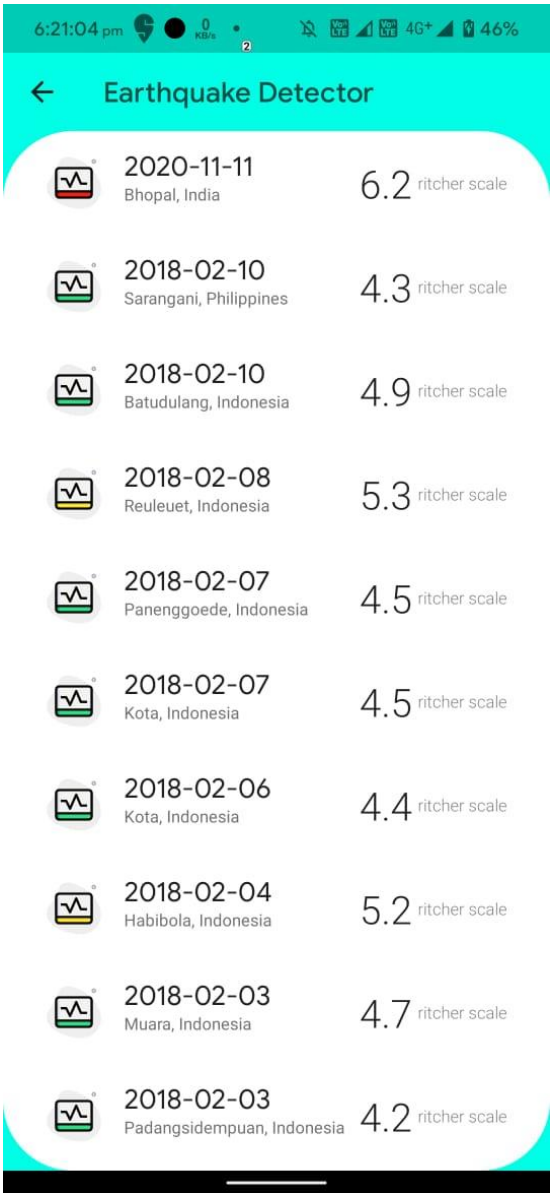



**Fig 9.3 Alert page**

### 9.1.4 Past Earthquakes

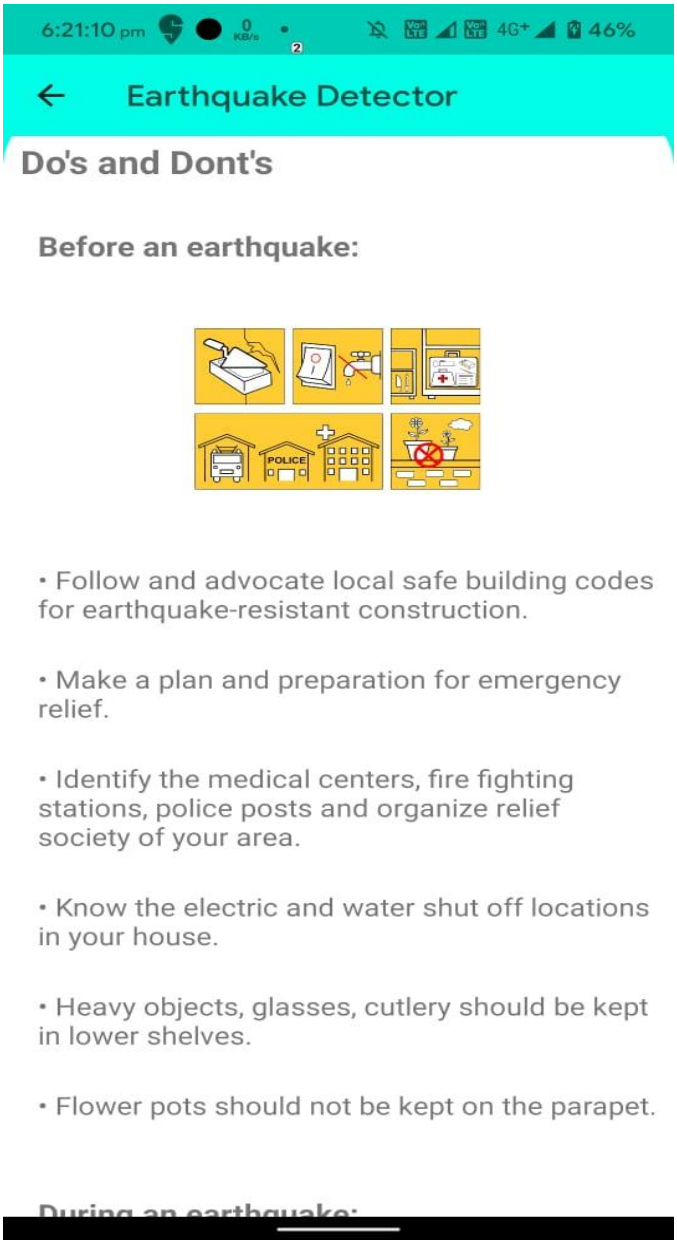
This views shows the recent earth quakes in this tab according to the locations.




### 9.1.5 Do's and Don't During Earthquakes

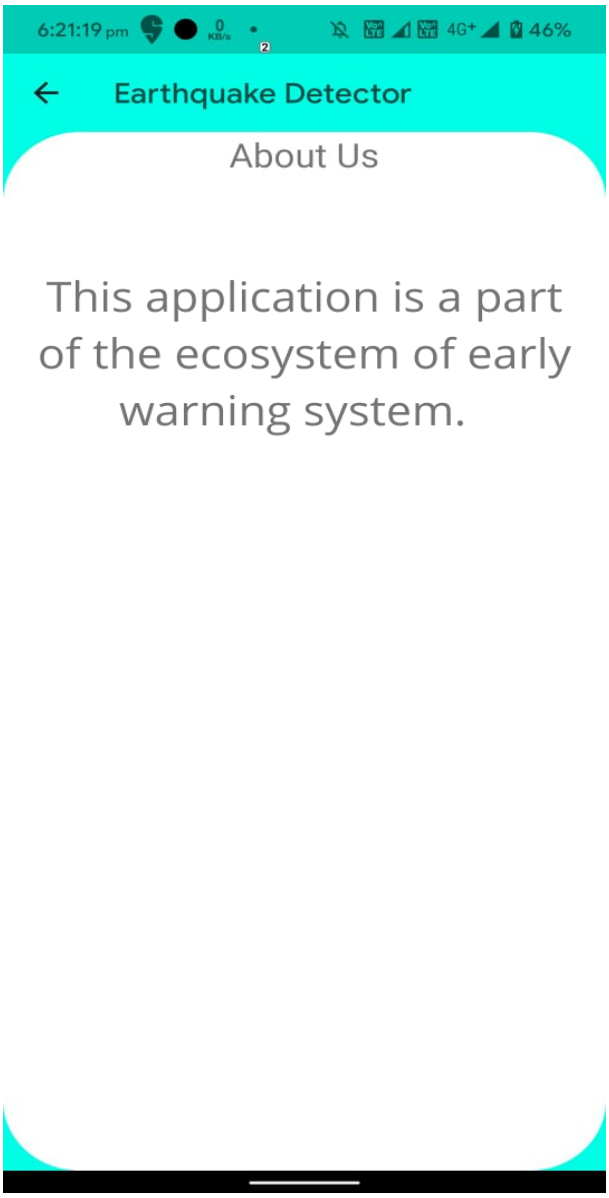
This tab shows about the do's and don'ts during earthquake. So that the user can take the

Right action during earthquake.



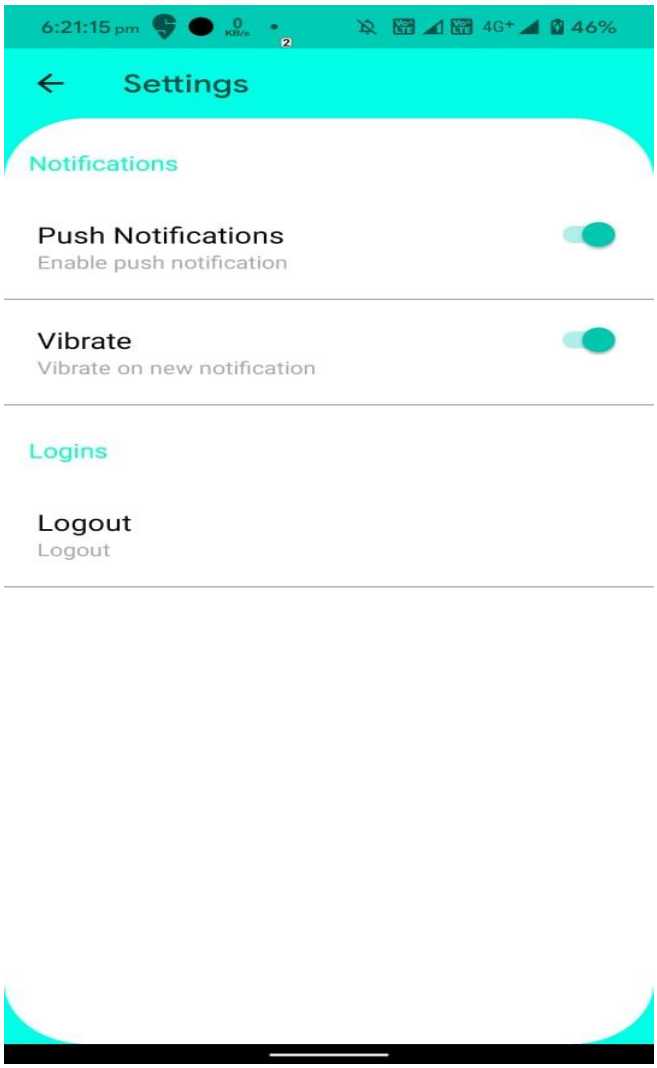
### 9.1.6 About us

This section shows about the intention and information about the developer and the ecosystem of the hardware device.



### 9.1.7 Settings Tab

This tabs allows the user to maintain the settings regarding the app and its notification.



## 9.2 Dashboard

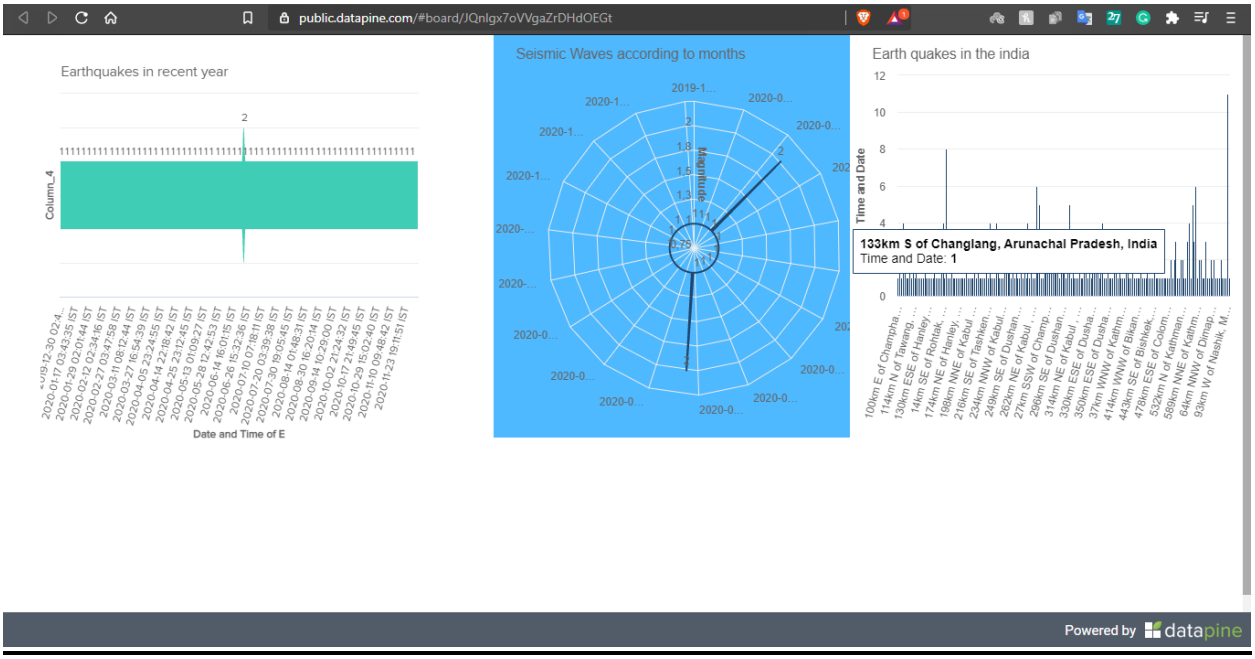
The dashboard is developed using the DataPine. Datapine provides an all in one data dashboard that provides an option for the predication and data analysis on the imbedded charts and GIS options based on the location centric data.

### 9.2.1 Dashboard Analysis Portal

This section allows the user to make the analysis of the data gathered from the hardware senor as well as national earthquake portal in the form of the flat files like csv.


### 9.2.2 Online Live Public Dashboard

All the data after the analysis will be available on the public data dashboard that displays the information about the earthquakes and seismic moments in the recent time with their intensity.


public.datapine.com/#board/JQnlgx7oVVgaZrDHdOEGt
Earthquakes in recent year
Column_4
Date and Time of E
Seismic Waves according to months
Magnitude
Earth quakes in the india
Time and Date
133km S of Changlang, Arunachal Pradesh, India
Time and Date: 1
Powered by datapine

# CHAPTER-10
# DEPLOYMENT

## 10.1 DEPLOYMENT

This chapter describes how to deploy the project on a fresh machine. It includes Installation steps & snapshots of pre-required software's like arduino, android studio etc. Installation steps & snapshots of the application developed under the major project. Configuration steps like entries required in database for proper run of the software.

### Installation of Arduino

Introduction to Arduino IDE, IDE stands for "Integrated Development Environment" it is an official software introduced by Arduino.cc, that is mainly used for editing, compiling and uploading the code in the Arduino Device. Almost all Arduino modules are compatible with this software that is an open source and is readily available to install and start compiling the code on the go. In this article, we will introduce the Software, how we can install it, and make it ready for developing applications using Arduino modules.

### 10.1.1 Download the arduino

You can get different versions of Arduino IDE from the Download page on the Arduino Official website. You must select your software, which is compatible with your operating system (Windows, IOS, or Linux). After your file download is complete, unzip the file.

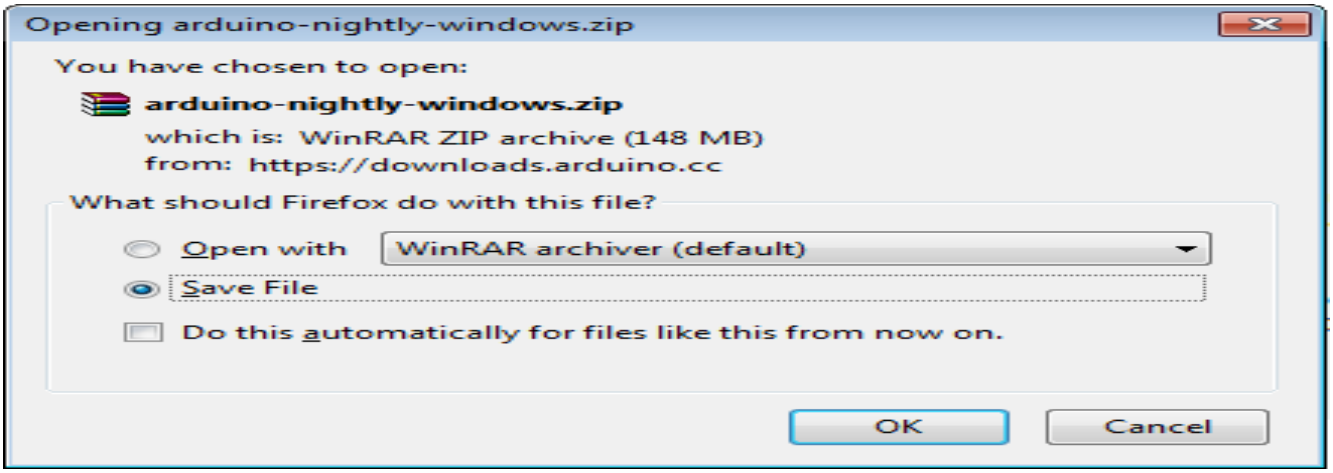



**Fig 10.1 Download page**

### 10.1.2 Launch arduino

After your Arduino IDE software is downloaded, you need to unzip the folder. Inside the folder, you can find the application icon with an infinity label (application.exe). Double-click the icon to start the IDE.

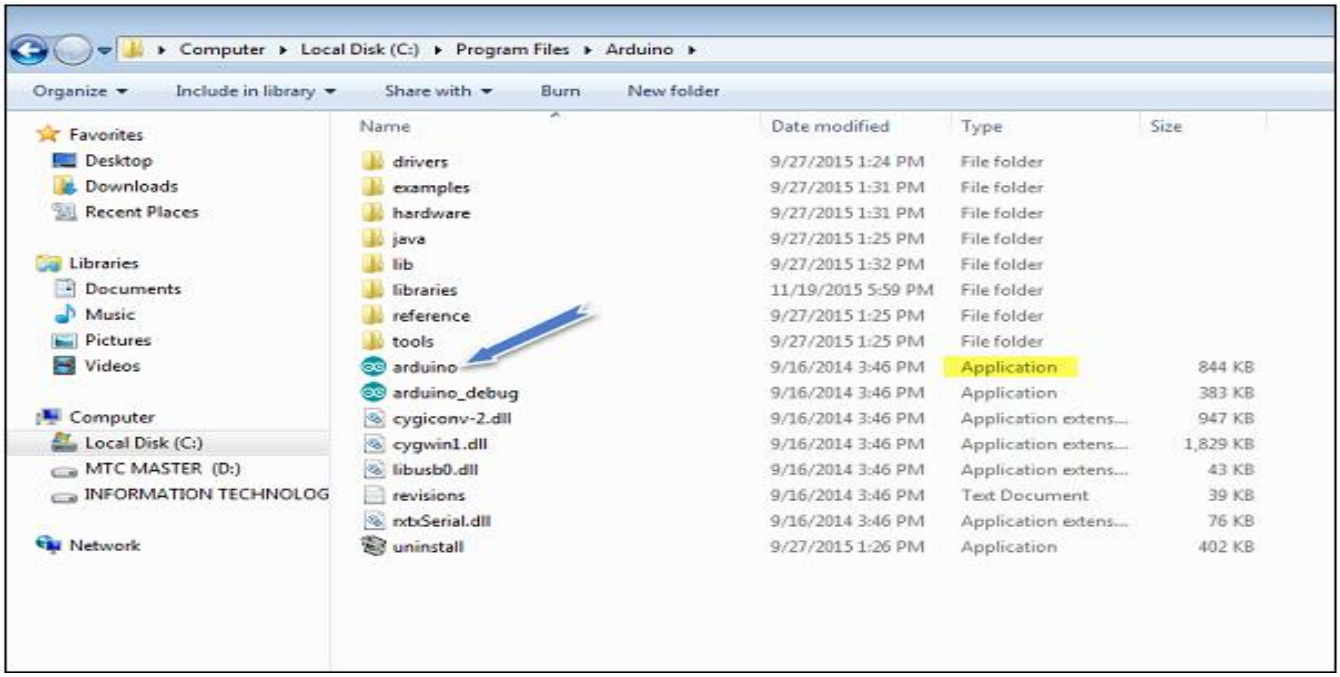



**Fig 10.2 launch**

### 10.1.3 Open your first project

Once the software starts, you have two options −

- Create a new project.
- Open an existing project example.

To create a new project, select File → **New**.

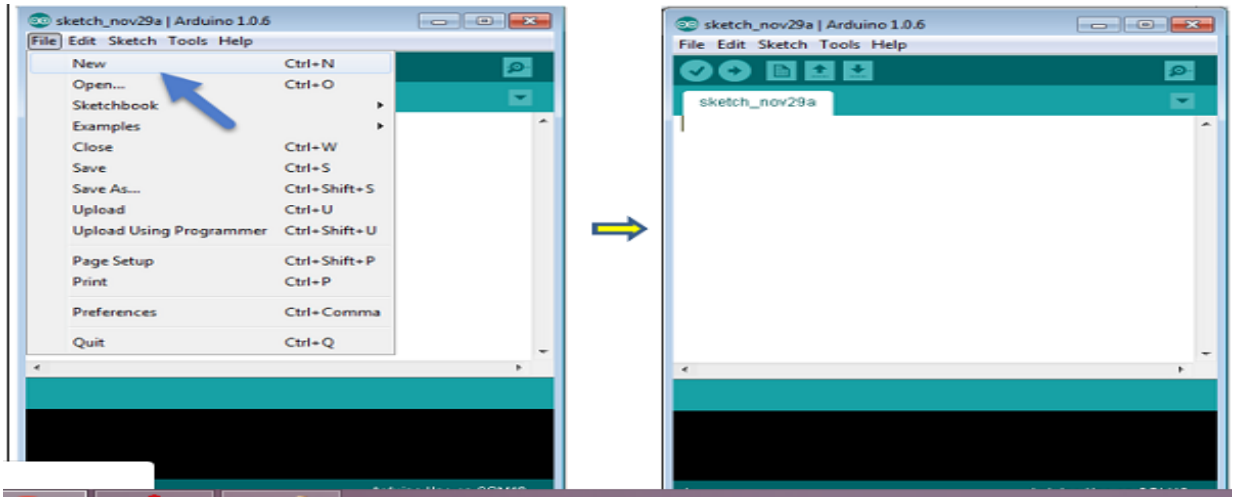



**Fig 10.3 Open the page**

## 10.1.4 Select arduino board

To avoid any error while uploading your program to the board, you must select the correct Arduino board name, which matches with the board connected to your computer.

Go to Tools → Board and select your board.

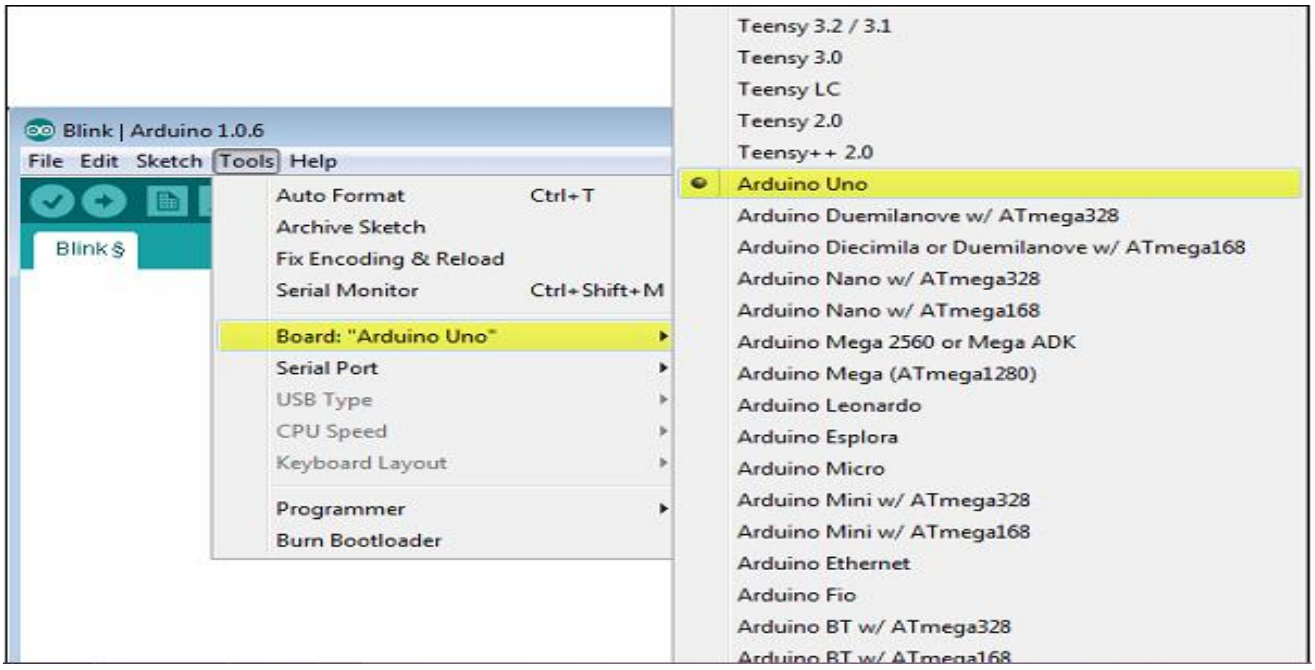



**Fig 10.4 Select board**

### 10.1.5 Select the serial port

Select the serial device of the Arduino board. Go to **Tools → Serial Port** menu. This is likely to be COM3 or higher (COM1 and COM2 are usually reserved for hardware serial ports). To find out, you can disconnect your Arduino board and re-open the menu, the entry that disappears should be of the Arduino board. Reconnect the board and select that serial port.

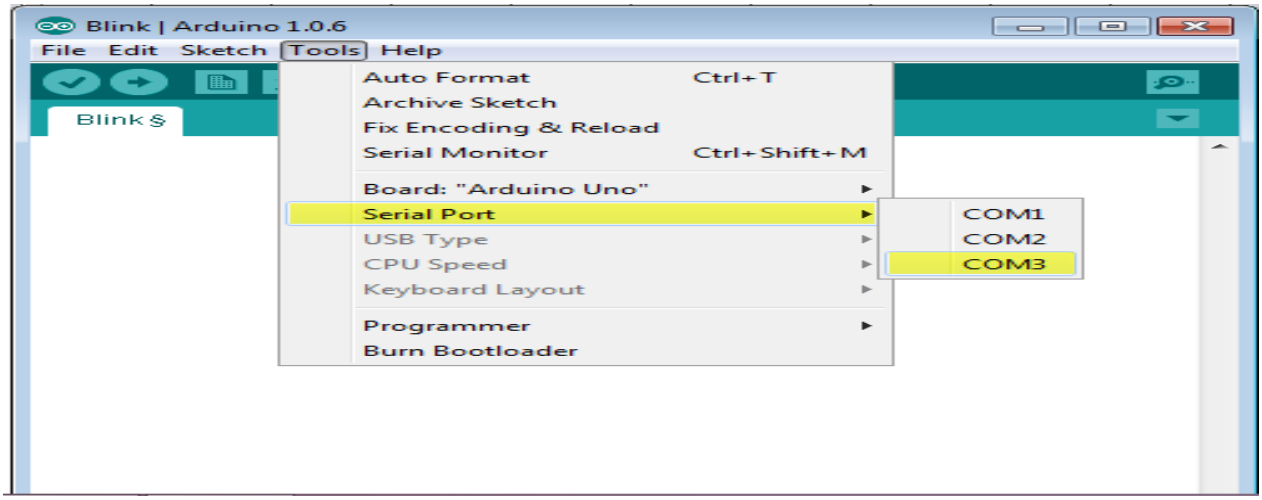



**Fig 10.5 Select port**

### 10.1.6 Upload the program

Before explaining how we can upload our program to the board, we must demonstrate the function of each symbol appearing in the Arduino IDE toolbar.

# Installation of Android Studio

Android Studio is the official integrated development environment for Google's Android operating system, built on JetBrains' IntelliJ IDEA software and designed specifically for Android development.

```
Operating system: Windows, macOS, Linux
Stable release: 3.1.3 (June 2018; 1 month ago)
Preview release: 3.2 Beta 5 (July 30, 2018; 1 day ago)
License: Freeware +Source code
Size: 854 MB compressed
Developed by: Google, JetBrains
```

**Installation guide:**

- **Step – 1 :**
  Head over to **this link** to get the Android Studio executable or zip file .
- **Step – 2 :**
  *Click on the download android studio button .*

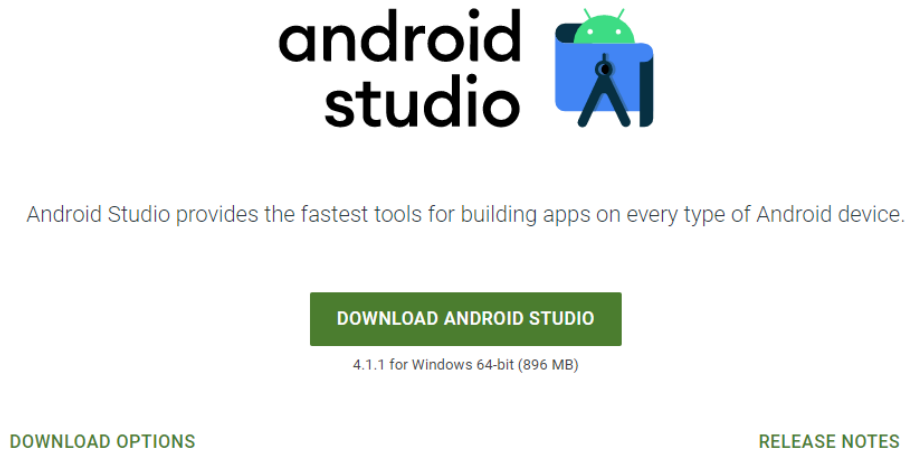
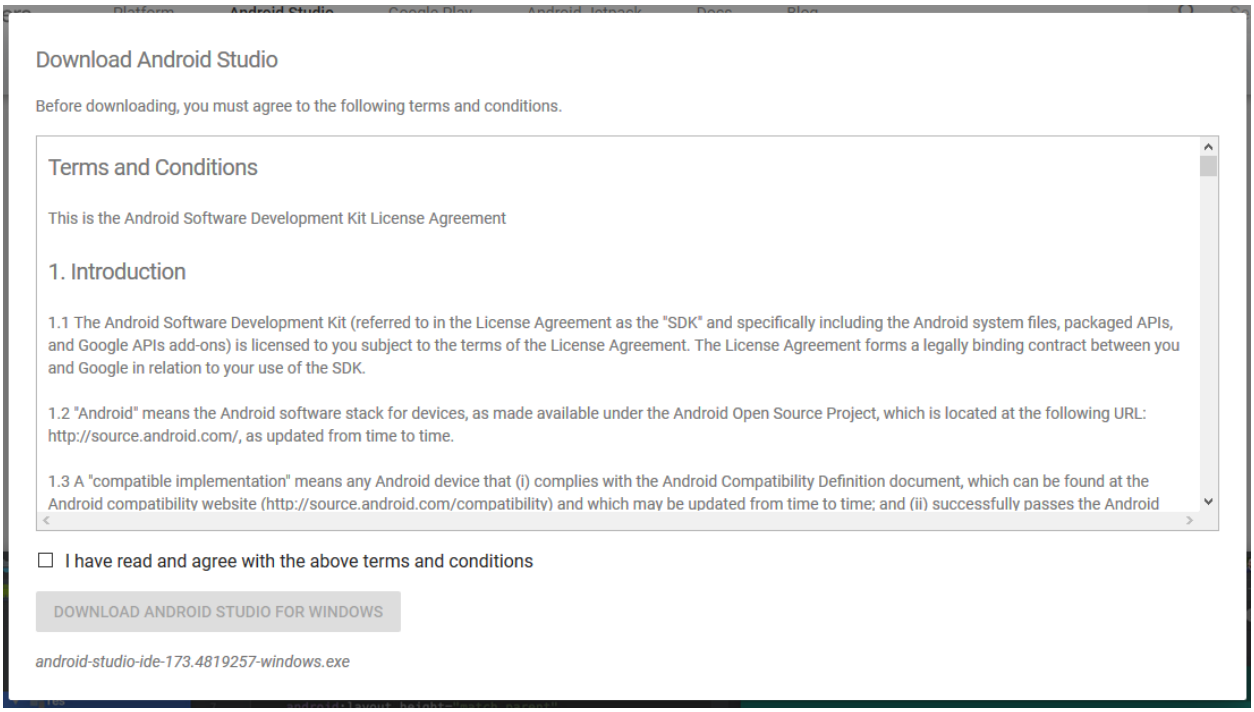



**Fig 10.6 Download Android Studio**

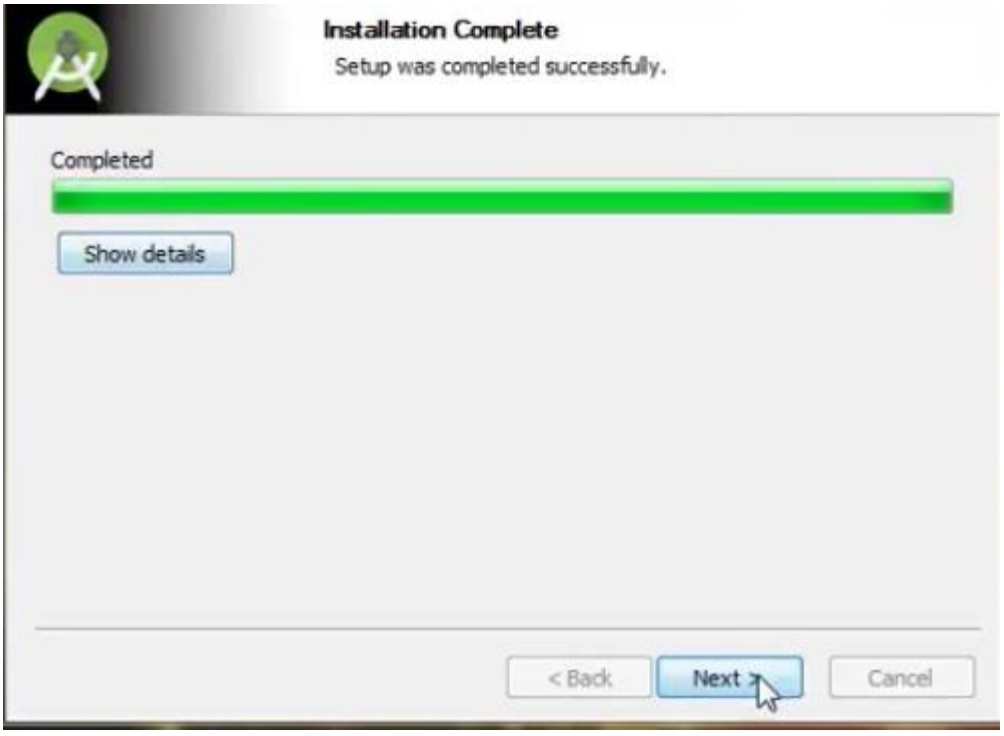
*Click on the "I have read and agree with the above terms and conditions" checkbox followed by the download button.*



- *Click on Save file button in the appeared prompt box and the file will start downloading .*
- **Step – 3:**
  After the downloading has finished, open the file from downloads and run it .
  It will prompt the following dialogue box .


- *Click on next .*
  In the next prompt it'll ask for a path for installation. Choose a path and hit next.

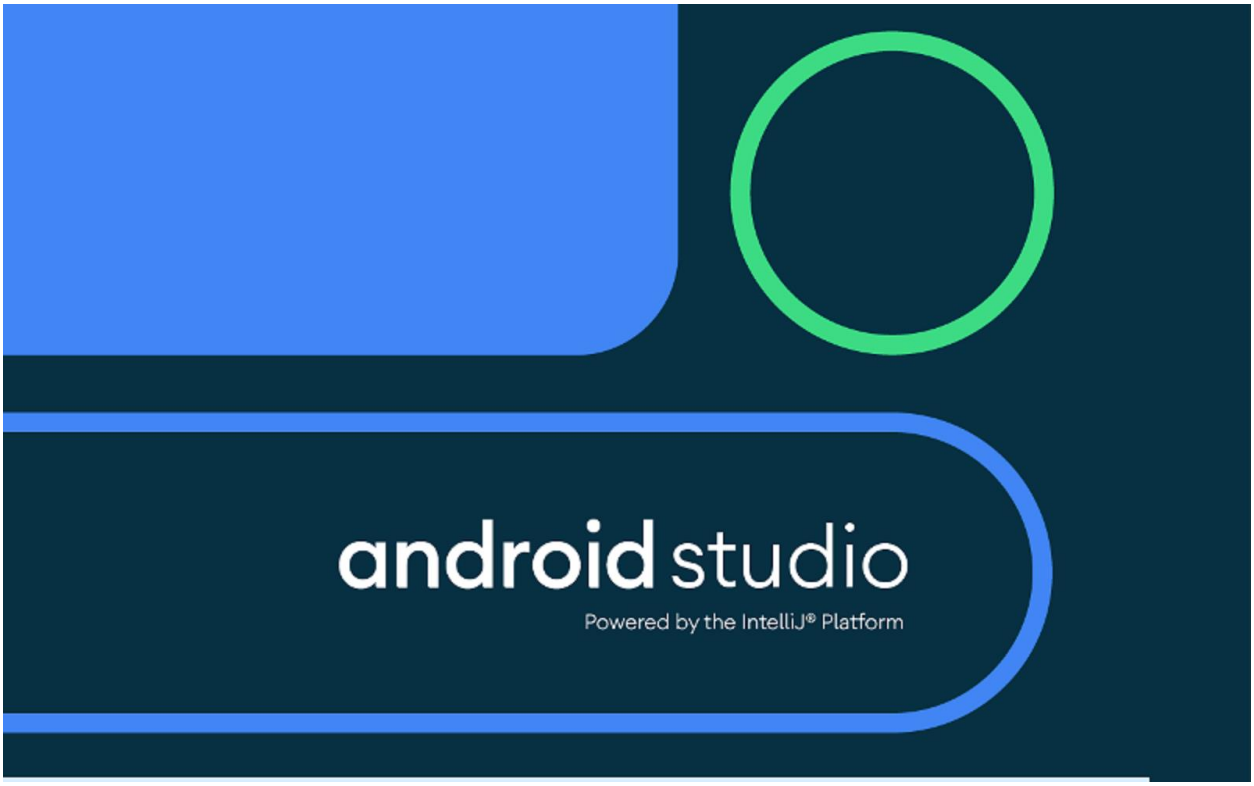
  **Note :**The installation path should have the required minimum space.
- **Step – 4 :**
  It will start the installation, and once it is completed, it will be like the image shown below .




**Step – 5 :**

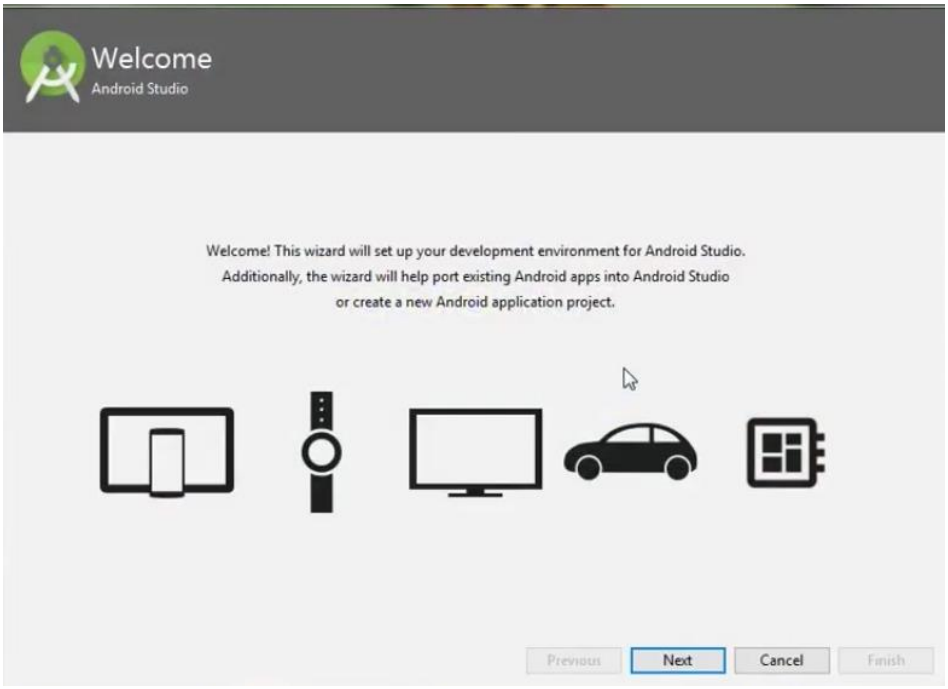
Once "Finish" is clicked, it will ask whether the previous settings needs to be impoerted [if android studio had been installed earlier], or not.
It is better to choose the 'Don't import Settings option' .


- 
- *Click the OK button.*
- **Step – 6 :**
  This will start the Android Studio.

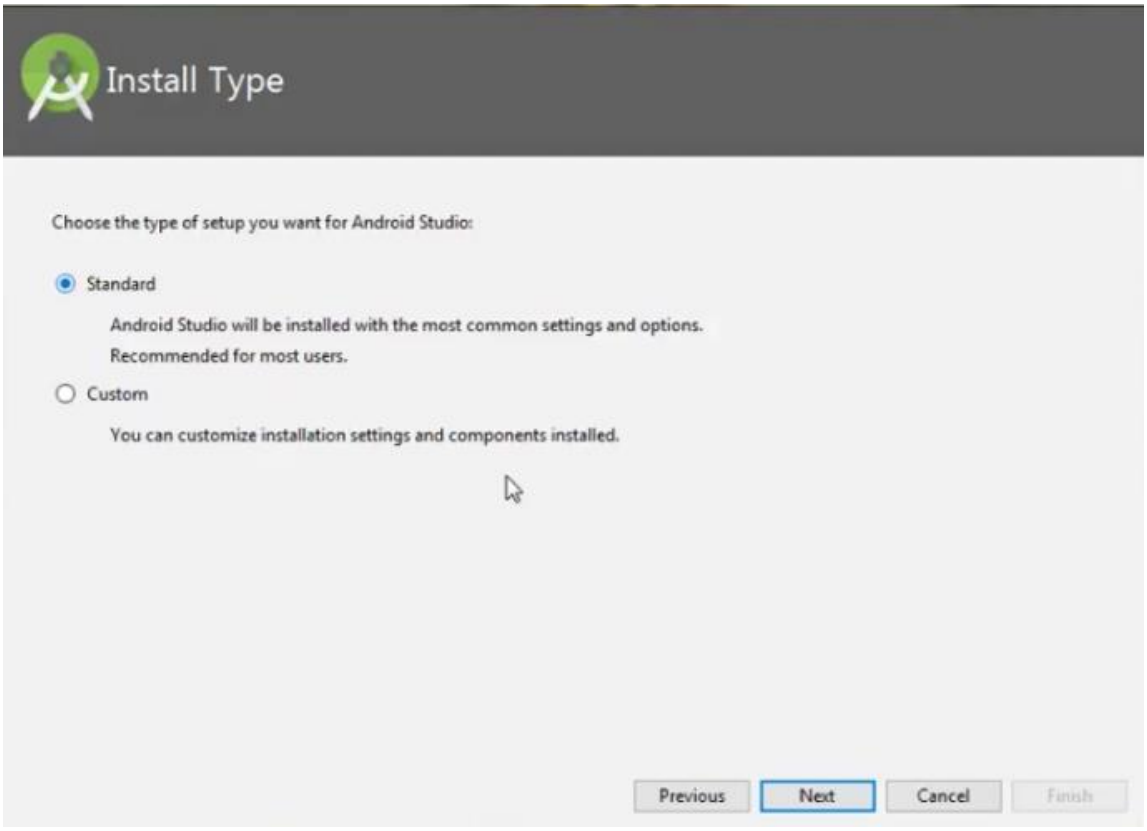



- Meanwhile it will be finding the available SDK components .

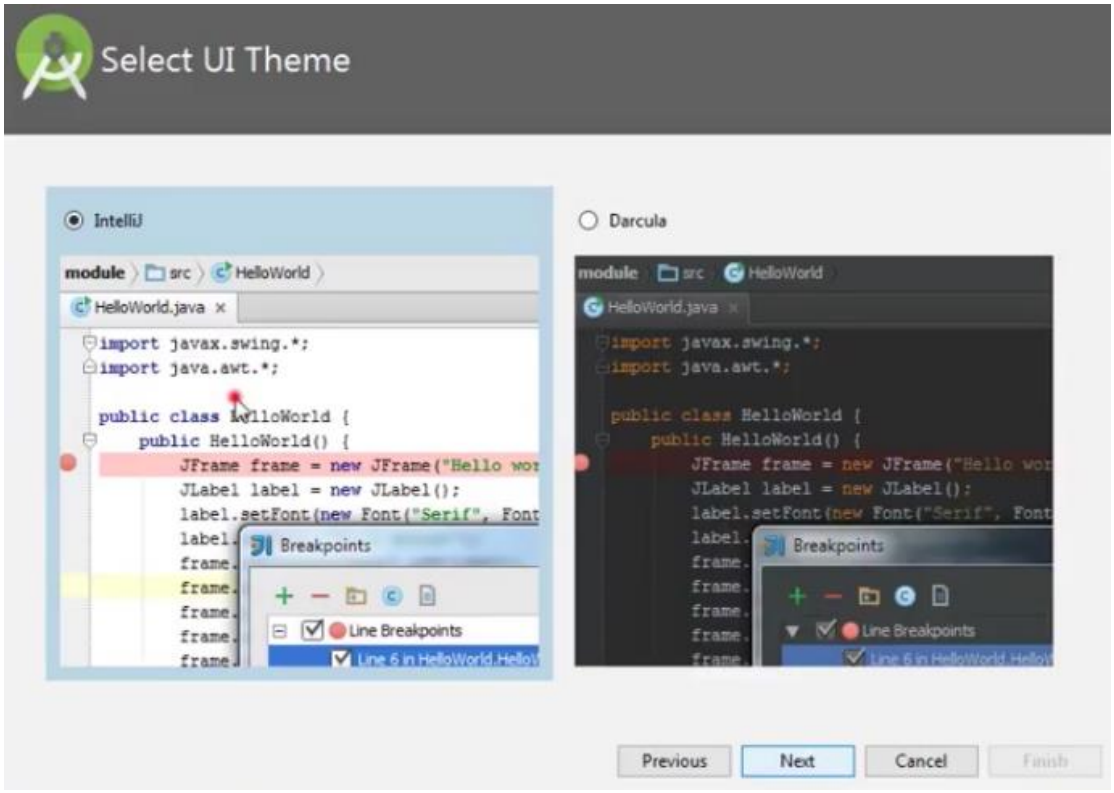

- **Step – 7:**
  After it has found the SDK components, it will redirect to the Welcome dialog box .




*Click on next .*

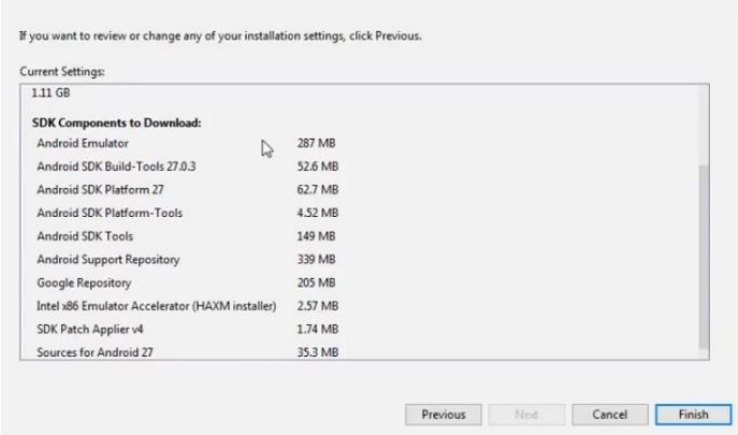


Choose Standard and click on Next.
Now choose the theme, whether Light theme or the Dark one .
The light one is called the IntelliJ theme whereas the dark theme is called Darcula .
Choose as required.

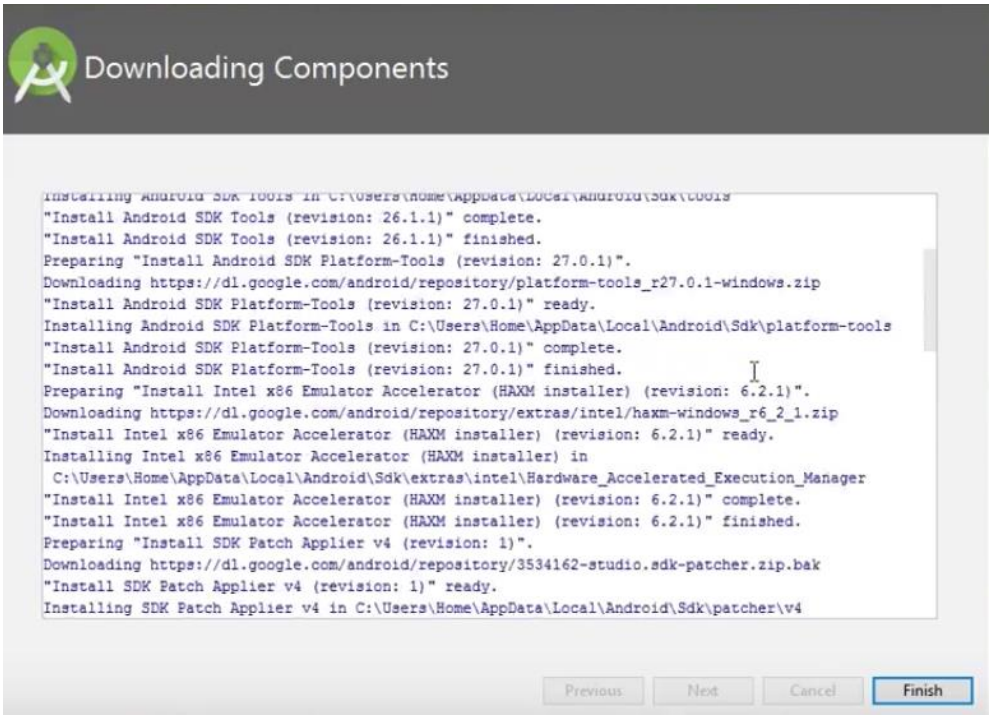



*Click on the Next button*

- **Step – 8 :**
- Now it is time to download the SDK components .



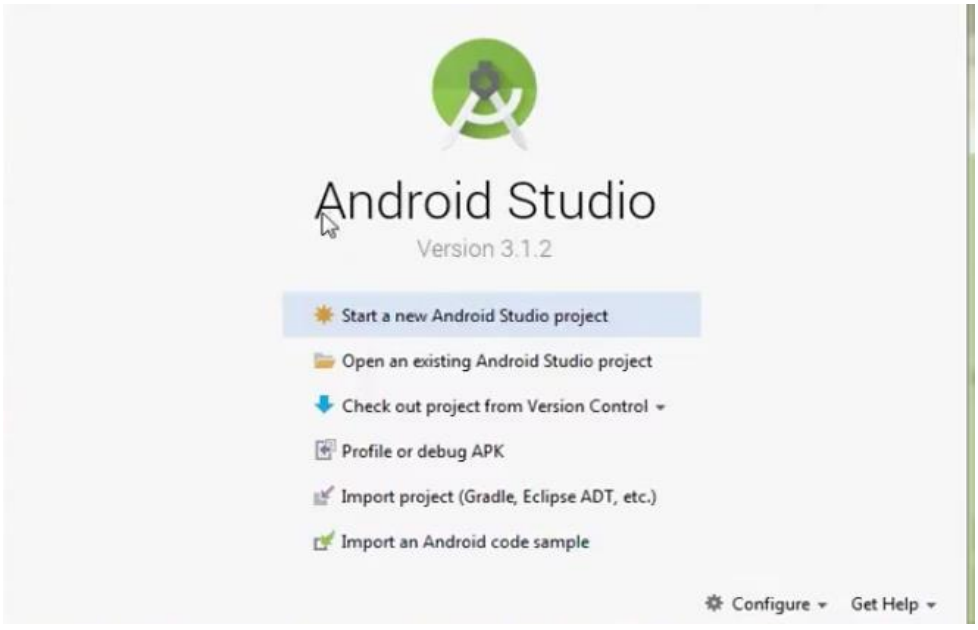
It has started downloading the components




The Android Studio has been successfully configured.
Now it's time to launch and build apps.

*Click on the Finish button to launch it.*

- **Step – 9 :**
*Click on 'Start new android project' to build a new app.*



# PROJECT SUMMARY

## *About Project*

| | |
|---|---|
| **Title of the project** | Earthquake Detection System |
| **Semester** | 5th |
| **Members** | Akash Dwivedi 0187CS181016<br>Akshat Kumar 0187CS181019<br>Shivam Soni 0187CS181142<br>Shubham Gupta 0187CS181144 |
| **Team Leader** | Akash Dwivedi |
| **Describe role of every member in the project** | **Akash Dwivedi**:- Simulation,Dashboard, Documentation<br>**Akshat Kumar** :- Android Development , firebase<br>**Shivam Soni** :- Sotware –Hardware Integration, IoT Hardware Developer<br>**Shubham Gupta** :- Android Development , firebase |
| **What is the motivation for selecting this project?** | Our goal was to provide an economical and affordable hardware and software based digital solution for Earthquake early-warning system to detect the first quivering of a major quake, triggering alarm systems in advance of the most violent shaking. . The alerts would allow businesses, residents, and public agencies time to get ready. The purpose of the study focuses on the sensor data to decide if an earthquake is occurring. |
| **Project Type (Desktop Application, Web Application, Mobile App, Web)** | IoT Device and Mobile App |

## *Tools & Technologies*

| | |
|---|---|
| **Programming language used** | Java, Android,Ardunio |
| **Compiler used (with version)** | IDE AVR-GCC Toolchain, Gradle |
| **IDE used (with version)** | Android Studio, Arduino IDE, Datapine |

| | |
|---|---|
| **Front End Technologies (with version, wherever Applicable)** | XML, Java |
| **Back End Technologies (with version, wherever applicable)** | FireBase,NoSQL |
| **Database used (with version)** | FireBase |

## ***Software Design & Coding***

| | |
|---|---|
| **Is the prototype of the software developed?** | Yes |
| **SDLC model followed (Waterfall, Agile, Spiral etc.)** | Iterative model |
| **Why is the above SDLC model followed?** | This model allows us to bring the changes in the existing works and provides a space for the future modification and enactments. |
| **Justify that the SDLC model mentioned above is followed in the project.** | We have started with the proof of concept analysis of our project. Later on we have developed an SRS for the complete project. After that part we started working on the initial hardware using the Arduino UNO and ADLX345 senor . Later on ESP8266 sensor was replaced for the hardware part as a microcontroller. For the storage part of the hardware we were using thinkspeak but later on completely switched to Firebase for the data storage and transferring of the values to firebase as it allows the analytical services and direct fetching to the mobile app |
| **Software Design approach followed (Functional or Object Oriented)** | Object Oriented |
| **Name the diagrams developed (according to the Design approach followed)** | Class Model<br>The class model allows us to show all the classes present in the system. The class model shows the attributes and the behavior associated with the objects. This provides an effective real life entity based project development. |

| | |
|---|---|
| **In case Object Oriented approach is followed, which of the OOPS principles are covered in design?** | For the purpose of the implementation of this project we have used class diagram. We have used class diagram to show the class model .The class diagram shows the class name followed by the attributes followed by the functions or the methods that are associated with the object of the class.Goal in constructing class model is to capture those concepts from the real world that are important to an application. |
| **No. of Tiers (example 3-tier)** | |
| **Total no. of front end pages** | 8 |
| **Total no. of tables in database** | Nil as NoSQL |
| **Database is in which Normal Form?** | Nil |
| **Are the entries in database encrypted?** | Firebase provides an in app data encryption |
| **Front end validations applied (Yes / No)** | *Yes* |
| **Session management done (in case of web applications)** | *no* |
| **Is application browser compatible (in case of web applications)** | *Dashboard is browser friendly* |
| **Exception handling done (Yes / No)** | *Yes* |
| **Commenting done in code (Yes / No)** | *Yes* |
| **Naming convention followed (Yes / No)** | Yes |
| **Total no. of Use-cases** | 1 |
| **Give titles of Use-cases** | Civilians -Hardware |

## ***Project Requirements***

| | |
|---|---|
| **MVC architecture followed (Yes / No)** | NO |
| **If yes, write the name of MVC architecture followed (MVC-1, MVC-2)** | Nil |
| **Design Pattern used (Yes / No)** | Yes |
| **If yes, write the name of Design Pattern used** | |
| **Interface type (CLI / GUI)** | GUI |
| **No. of Actors** | 1 |
| **Name of Actors** | User |
| **Total no. of Functional Requirements** | 4 |
| **List few important non-Functional Requirements** | Reliability, Consistency, Real time , Accuracy |

## ***Testing***

| | |
|---|---|
| **Which testing is performed? (Manual or Automation)** | Manual |
| **Is Beta testing done for this project?** | Yes |

## ***Write project narrative covering above mentioned points***

With this project we have provided a development of the hardware and software solution for the Seismic waves and providing an alert message to the civilians so that precious lives of the people can be saved. The user friendly apps collect very basic information like location and name, email and password. This information will allow us to send the specialized message according to the location of the device. The sensor that we have used is an economical sensor and is easily helpful in monitoring the acceleration of the axis data. This app shows the information regarding the seismic moments in the form of the trigger notifications. We also have set up a dashboard for the seismic moments which is driven by the dataset of the seismic data from the dataset of the government of the India's database of the seismic waves.

**Group Members:**

Guide Signature

Akash Dwivedi 0187CS181016 (Project Guide name)

Akshat Kumar 0187CS181019

Shivam Soni 0187CS181142

Shubham Gupta 0187CS181144

# APPENDIX-1

# GLOSSARY OF TERMS

**A**

**ARDUINO:** Arduino is an open-source electronics platform based on easy-to-use hardware and software.

**C**

**CONNECTED DEVICE :** Components that make up the Internet of Things. Many have built-. In sensors and/or actuators and collect data to help users or other devices make informed decisions and monitor or affect outside events.

**E**

**EMBEDDED C :** Embedded C is for microcontroller based applications. Embedded C has to use with the limited resources, such as RAM, ROM, I/Os on an embedded processor**.**

**EMBEDDED DEVICE/SYSTEM** : A computer with a dedicated function within a larger mechanical or electrical system; it is embedded as part of a complete device.

**I**

**INTERNET OF THINGS** : A network of objects (such as sensors and actuators) that can capture data autonomously and self-configure intelligently based on physical world events, allowing these systems to become active participants in various public, commercial, scientific, and personal processes.

**IOT DEVELOPMENT BOARD** : A board that can be used to prototype and create IoT hardware. There are several boards available on the market with different features.

**L**

**LOW-POWER DEVICES** : Electronics that have been designed to use less electric power than traditional devices. These are necessary to the future success of IoT because, as sensors become more advanced, devices need to be able to operate for longer periods of time without relying on manual maintenance or loss of data.

**M**

**MICROCONTROLLER (MCU)**: A small computer on a single integrated circuit designed for embedded applications and used in automatically controlled embedded systems.

**S**

**SENSOR**: A device or component that perceives and responds to physical input from the environment.

**SENSOR NETWORK :** A group of sensors with a communications infrastructure intended to monitor and collect data from multiple locations.

**W**

**Wi-Fi** : A wireless local area network (WLAN) that uses radio waves to provide wireless high-speed Internet and network connections.

# APPENDIX-2

# REFERENCES

**Seismograph IoT**

https://earthscience.stackexchange.com/questions/9822/using-accelerometer-as-a-seismograph

**ESP8266**

https://blog.milesburton.com/2019/01/20/interfacing-the-esp8266-esp32-microcontroller-with-adxl345-accelerometer/

**ADLX345 sensor**

https://www.analog.com/media/en/technical-documentation/data-sheets/ADXL345.pdf

**Proof Of Concept**

https://www.researchgate.net/publication/326137583_Development_of_Earthquake_Early_Warning_System_Using_ADXL335_Accelerometer

**Google Earthquake Detection Project using accelerometer**

https://blog.google/products/android/earthquake-detection-and-alerts/

**Seismic Data**

https://seismo.gov.in/MIS/riseq/earthquake/recent_earthquake