

# INTRODUCTION

## 1.1 About project in brief

The MHWSS aims to collect, analyze, and interpret data related to various aspects of mental health, including prevalence rates, risk factors, protective factors, access to care, and outcomes. By utilizing diverse data sources such as population surveys, electronic health records, social media analytics, and community-based assessments, the MHWSS provides a multi-dimensional understanding of mental health dynamics.

The MHWSS comprises a network of data collection devices deployed across various community settings, including hospitals, clinics, schools, and workplaces. These devices are equipped with advanced sensors capable of capturing physiological data, such as heart rate variability, sleep patterns, and physical activity levels, alongside self-reported subjective measures of mental well-being. Additionally, wearable technologies and smartphone applications are integrated into the system to enable continuous monitoring and real-time data transmission.

The MHWSS incorporates sophisticated algorithms for data processing, analysis, and visualization. Machine learning techniques are employed to identify patterns and correlations within the collected data, facilitating early detection of mental health issues and prediction of potential risks. Furthermore, the software includes a user-friendly interface for clinicians, policymakers, and researchers to access aggregated data, generate reports, and make informed decisions regarding intervention strategies and resource allocation.

In conclusion, the establishment of a Mental Health and Well-being Surveillance System represents a pivotal advancement in public health infrastructure, offering a comprehensive framework for monitoring and addressing mental health challenges proactively. By promoting early intervention, prevention, and holistic approaches to mental health care, the MHWSS contributes to fostering resilient communities and improving the overall well-being of populations worldwide.

## **1.2 Literature survey**

In the course of the recognition of mental health as an essential component of population health, the Robert Koch Institute has begun developing a Mental Health Surveillance (MHS) system for Germany. MHS aims to continuously report data for relevant mental health indicators, thus creating a basis for evidence-based planning and evaluation of public health measures. In order to develop a set of indicators for the adult population, potential indicators were identified through a systematic literature review and selected in a consensus process by international and national experts and stakeholders. The final set comprises 60 indicators which, together, represent a multidimensional public health framework for mental health across four fields of action. For the fifth field of action 'Mental health promotion and prevention' indicators still need to be developed. The methodology piloted proved to be practicable. Strengths and limitations will be discussed regarding the search and definition of indicators, the scope of the indicator set as well as the participatory decision-making process. Next steps in setting up the MHS will be the operationalisation of the single indicators and their extension to also cover children and adolescents. Given assured data availability, the MHS will contribute to broadening our knowledge on population mental health, supporting a targeted promotion of mental health and reducing the disease burden in persons with mental disorders.

While there are no comprehensive MHWSS solutions currently in widespread use, several initiatives address specific aspects of this project. For Example, National mental health surveillance programs, like those by the CDC, that focus on broad population trends, School-based mental health screening programs with limitations in scope and follow-up, Mobile apps and online resources for mental health self-management, lacking a comprehensive support system.

## **1.3 Problem Statement**

Currently, mental health concerns among individuals often go undetected until they escalate, leading to poorer long-term outcomes. The existing methods rely heavily on self-reporting or identification by parents, educators, or peers, which can be limited. To address these limitations, we are developing a comprehensive system for monitoring mental health trends and proactively identifying at-risk individuals. This system aims to facilitate early

intervention and ensure effective resource allocation, thereby improving long-term outcomes for mental health.

## **1.4 Scope of the Project**

The scope of an MHWSS can vary depending on its goals and resources. Here's a breakdown of some key considerations:

### **1.Data Sources:**

- Self-reported surveys and questionnaires
- Existing healthcare records (anonymized)
- Social media analysis (with privacy safeguards)
- School records (parental consent required)

### **2. Data Analysis:**

- Identifying populations at risk for mental health problems
- Monitoring trends in mental health prevalence
- Evaluating the effectiveness of mental health interventions

### **3. Target Population:**

- General population surveillance
- Specific high-risk groups (e.g., youth, veterans)

### **4. Information Sharing:**

- Public health officials
- Mental health professionals
- Policymakers
- Individuals (with clear opt-in options)

## **1.5 Important Considerations:**

- **Privacy and Security:** MHWSS must prioritize robust data security and user privacy.
- **Standardization:** Data collection methods and analysis techniques should be standardized for accurate comparisons over time and across populations.
- **Stigma Reduction:** The system should be designed to reduce stigma around mental health by promoting help-seeking behavior.
- **Intervention and Support:** The MHWSS should be linked to resources and interventions for those identified as needing help.

This project focuses on developing the core functionalities of the MHWSS for adults. The scope includes:

- Design and implementation of a secure platform for data collection and management, potentially integrating with existing sources like school records and anonymous surveys.
- Development and validation of age-appropriate mental health assessments and risk-factor identification algorithms.
- Creation of a library of evidence-based interventions, including online resources, mobile apps, and connections to mental health professionals.
- Building a secure communication and collaboration platform for parents, educators, and mental health professionals.
- Exploration of the potential for incorporating wearable technology data (with strict opt-in and privacy controls) for additional insights.

## **1.6 Objectives**

The primary objectives of the project are:

1. **To develop a system for early identification of potential mental health concerns in adults.**
2. **To provide a platform for delivering evidence-based interventions and support resources to adults and families.**
3. **To facilitate collaboration among parents, educators, and mental health professionals.**
4. **To collect and analyse data to improve understanding of mental health trends in adults.**

Based on the primary objectives outlined for the project, here are major and minor objectives aligned with each primary objective:

**Primary Objective 1:** To develop a system for early identification of potential mental health concerns in adults.

**Major Objective:**

1. Develop an assessment framework incorporating validated screening tools and methodologies for early detection of mental health concerns.

**Minor Objectives:**

- 1.1. Identify and adapt existing mental health screening tools suitable for adults.
- 1.2. Design and implement a user-friendly interface for administering assessments to adults.
- 1.3. Integrate data collection mechanisms to gather information from multiple sources (e.g., caregivers, teachers).
- 1.4. Establish protocols for the timely review and analysis of assessment results.
- 1.5. Incorporate machine learning algorithms for automated analysis and pattern recognition in assessment data.

**Primary Objective 2:** To provide a platform for delivering evidence-based interventions and support resources to adults, adults and families.

**Major Objective:**

2. Develop an interactive platform that delivers personalized interventions and support resources based on assessment outcomes.

**Minor objectives**

- 2.1. Collaborate with mental health professionals to curate a repository of evidence-based interventions.
- 2.2. Design an intuitive platform interface accessible to both adults and caregivers.
- 2.3. Implement features for personalized recommendations based on assessment results.
- 2.4. Integrate multimedia content (e.g., videos, interactive modules) to enhance engagement and learning.
- 2.5. Ensure accessibility and inclusivity by catering to diverse learning styles, and needs.

**Primary Objective 3:** To facilitate collaboration among parents, educators, and mental health professionals.

**Major objective**

3. Establish a communication and collaboration framework to facilitate information sharing and coordination among stakeholders.

**Minor Objectives:**

3.1. Develop a secure and user-friendly communication platform for stakeholders to interact.

3.2. Provide resources and training for educators and caregivers to recognize and respond to mental health concerns.

3.3. Implement features for real-time updates and notifications on assessment outcomes and interventions.

3.4. Organize regular meetings and workshops to foster collaboration and knowledge exchange.

3.5. Integrate feedback mechanisms to solicit input and suggestions from stakeholders for continuous improvement.

**Primary Objective 4:** To collect and analyse data to improve understanding of mental health trends in adults.

**Major Objective:**

4. Establish a data collection and analysis framework to gather insights into mental health trends and factors influencing adult's well-being.

**Minor Objectives:**

4.1. Design data collection protocols compliant with ethical and privacy standards.

4.2. Develop data analytics pipelines for processing and analyzing diverse datasets.

4.3. Identify key metrics and indicators for monitoring mental health trends over time.

4.4. Conduct regular evaluations to assess the effectiveness of interventions and identify areas for improvement.

4.5. Generate reports and visualizations to communicate findings to stakeholders and the broader community.

## **2. Software and hardware requirements for implementing a MHWSS**

### **2.1 Software Requirements:**

#### **2.1.1. Data Collection and Integration Software:**

- Custom software or platforms capable of collecting and integrating data from various sources such as population surveys, electronic health records, social media analytics, and community-based assessments.
- Integration with wearable technologies and smartphone applications for real-time data transmission.
- Arduino IDE is used for Integrating the software.

#### **2.1.2 Data Processing and Analysis Software:**

- Software with advanced algorithms and machine learning techniques for processing, analysing, and visualizing data collected by the system.
- Statistical analysis software for identifying patterns and correlations within the data.

#### **2.1.3. User Interface and Reporting Software:**

- User-friendly interface for clinicians, policymakers, and researchers to access aggregated data, generate reports, and make informed decisions.
- Dashboard or visualization tools for presenting data in an understandable format.

#### **2.1.4. Security Software:**

- Robust security measures to protect sensitive health data collected by the system, including encryption protocols and access controls.

#### **2.1.5 Data Storage and Processing Infrastructure:**

- Servers or cloud infrastructure capable of storing and processing large volumes of data collected by the system.
- Sufficient processing power and storage capacity to handle data processing tasks efficiently.

- Reliable network infrastructure to facilitate data transmission between data collection devices, wearable technologies, smartphones, and central data storage/processing facilities.
- High-speed internet connectivity to ensure timely and seamless data transfer.

#### **2.1.6 Security Measures:**

- Physical security measures to protect hardware devices deployed in community settings.
- Network security measures to safeguard data transmission and storage against unauthorized access or cyber threats.

## **2.2 FUNCTIONAL AND NON-FUNCTIONAL REQUIREMENTS**

### **2.2.1 Functional requirements :**

This section lists the functional requirements in ranked order. Functional requirements describe the possible effects of a software system, in other words, what the system must accomplish.

Other kinds of requirements (such as interface requirements, performance requirements, or reliability requirements) describe how the system accomplishes its functional requirements. Each functional requirement should be specified in a format similar to the following:

The Functional requirement of Mental health well-being will be the imperative sentence stating highest ranked functional requirement.

- **Registration:** - If User is a new, the system shall let the User to register to the system via Social Network or via register form.

- **Login:** - The system shall let the User login in. User will have to register providing their input username and password which will be validated and authenticated on the server side. Most importantly is that all the data that are going to the server side will be encrypted.

- **Forgot Password:** User shall be able to change or reset their password if they want to.



- **Selecting Option Category:** System shall let the User to select category (Workout, Relaxation sound or Calorie counter).

- **Monitoring progression:** System shall record progress of user Workout activity. User should be able to use a wearable device and get their exercise result on their application.

- **Monitoring Calories:** System shall allow User to get their Total Daily Energy Expenditure, search food intake, view and record their meal counter.

- **Improving sleep:** System shall allow user to select audio to helps the user relax, meditation audio to help improve self-care and pink sound to help user to fall asleep with ease.

- **Support Services:** System shall allow user to view who they can go to for help information and view video of real life stories and how littlething worked for them getting through rough time.

- **Quiz:** System shall allow user to take a mental health quiz to engage user in a fun and challenging way to test their knowledge on mental health.

#### **2.2.1.1 Data requirements(System requirements):**

This will describe the data requirements, which are essential to implementing the functionalities of the application. The data stored, and data user needs may be accessible and available all times. For user to access the application, the user provides name and email which will be stored or require from a database.

- User activity record Workout– application will be recording the user’s exercise activity to get back where they left off.
- User activity record Calories – application will be record and storing the Calories intake and shows the analysis.
- Google Firebase – The application will store all the data in the non-SQL back end system, this will involve user’s profiles.
- The back-end system will be link with the application using the dependencies added in the configuration files of application.

### 2.2.1.2 User requirements

The user requirement of Mental health Well-being is to incorporate an application to improve mental health well-being. Find a way to motivate people with mental health issue using technology to solve this problem. The “The Little things” campaigns highlight some of the important area to improve day to day basic. Client expectations of a mental health application are:

**Fitness:** The application will provide a workout plan for the user. User can do the exercise at comfort of their home because there are users who doesn’t feel comfortable going to the gym. The application tracks their progression and user is able to pick the level of activities that best suit their need.

**Diet:** The application will provide a calories counter and provide the day to day calories intake of Users. Along with this functionally, the application will provide how to improve diet and provide easy to make recipes that the user can effort in further development.

**Sleep improvement:** The application will provide relaxation section where user can listen to audio of meditation, breathing mediation techniques and pink noise to give user ease to improve their breathing and to sleep at ease.

**Support services:** The app will allow the user to get support from expert by calling direct from the app. Also, to few information they need to help them in any way possible. This feature also allows the user to watch past victim and how The Little Things campaign help them. Android (4.4 or higher): The user will need a mobile Android device and will need version 4.4 or higher for faster loading and working better. Internet access: The device will need Internet access to use the application because it has to connect to a server to retrieve information. The faster the internet the faster the server get and post requests (Adekanmbi, 2015/2016).

### User Requirements Definition

This section describes the set of objectives and requirements for the system from the customer’s perspective. What are the clients saying they want?

- System should allow User to create an account and/or log in
- System should allow User to create a workout.

- System should allow User to view workout progress
- System should allow User to add Calories Counter
- System should allow User to select option to help them improve sleep.
- System should allow User to call for help
- System should allow User to browser for support

#### **2.2.1.3 Environmental requirements**

These are the vital requirements that must be present when developing the application.

- **Android Device:** An android device will require during the running and testing of application in the development stages. The mobile application environment will need to be able to push and synchronous to ensure user can gain access to there information.
- **Internet Access:** Internet access is required to test functions in application and connecting to database.
- **Laptop(Window):** This application will be developed Windows laptop with android studio as the Android development IDE.
- **Photoshop/Paint 3D:** Photoshop was used to customize any images and graphical assets used during the development of my application.

#### **2.2.1.4 Usability requirements**

This section will cover and evaluate the usability requirements for the system application. This outline the standards and objectives to be met regarding the systems.

- **Ease of use:** The application is user friendly and easy to use.
- **Understandability:** The system is understandable to use. Easy to follow the functionality.
- **Operability:** The system should perform as mentioned in the requirement. The app should be consistent in terms of functionality.
- **Attractiveness:** The application should be appealing to users (GUI, Design and layout). The app should use colour that is easy for the eye.

### **2.2.2 Non-Functional requirements**

The divergence between Functional Requirement and Non-Functional Requirement is Functional Requirement deal with what the system shall and much do, while Non Functional Requirement focuses on, How the system operate.

#### **Performance/Response time requirement:**

Performance and system response times are conjoined in that one can affect the other. It is a determination of what is acceptable to a user as adequate performance/response time. Both are response times variables dependent upon many factors that could affect either but in general 0.2 or 0. second(s) is what is to be expected and what can be defined to a user as an unnoticeable instantaneous response of the system to an action triggered by the user. 1.0 second(s) is mildly disrupting and noticeable but still within the spectrum of the user feeling they've operated the system. Anything above and beyond this time frame can cause a user to ultimately lose interest in the application. Mental Health well-being mobile application should be fast in response. The login process should take 0.2 second once the user clicks submit. The performance and the response are crucial for the success of the application because the application will be capturing, measuring activity, calorie counter of the User and we don't want any error. Also, to keep the user engage with the app. Internet connection and strength will proportional on the requirement performance. The faster the internet the faster data pass and load and if the internet is slow it will have the opposite effect. The user's hardware could also prevent ample performance and response time of the system. It is important as such to assess the performance of the system under both gradual pressure and immediate high traffic scenarios. Client-side testing, Network testing and server-side testing will be implemented and as well as specifying the following:

1. Response Time
2. Workload - Work that the system must support
3. Scalability – Increase in system workload that the system should be able to

Process

4. Platform – Hardware and software (Operating System & Software Utilities) that houses the system

### **Availability requirement**

Availability refers to the periods in which a solution can be used, in this case, the time frame in which the application will be available and use. Dependent upon the application in which availability requirements are enlisted, there may be designated times in which the system can be used and under maintenance. Relation to the project the aimed availability requirement is that of 99.999%. In reality, 100% cannot be guaranteed and would have cost limitations restricting the robustness of the solution. Reliability, Security and Robustness are another non-functional requirement that are related to the available requirement. Internet connect will have to be used to connect to the application and to interact with the database.

### **Recover requirement**

The recovery is the area of security that must be put in place if there were a significant negative event. In the case of system shutdown and no response to the user. The system should be down and shouldn't take no more than one to two working day for the system to be back. Also, Information will be send to the user to let them know when the system is back working.

### **Security requirement**

Security will be considered throughout the application life cycle to prevent manipulation of data impacting data integrity, quality and the developer reputation. Security is extremely important. If user don't think the system is secure they will not download the application. Security measure will be in place to protect from hackers and unauthorized access to the system which holds sensitive data of users. Solid authentication and validation will be in the system when users are logging in to the system with their correct credentials.

Any sensitive information will be encrypted in the database. Also, SQL injection will be prevented in the application. SQL injection is an attack that involves sending modified SQL statements to application that will, in turn, modify a database. Attackers can send unexpected input through input field which will enable them to read from, write to, and even delete entire databases.

**Portability requirement:** The application will cater to different Android version. The Android API version the application will support are:

- Android 4.4 KitKat (API 19)

- Android 4.4W KitKat, with wearable extensions (API 20)
- Android 5.0 Lollipop (API 21)
- Android 5.1 Lollipop (API 22)
- Android 6.0 Marshmallow (API 23)
- Android 7.0 Nougat (API 24)
- Android 7.1 Nougat (API 25)
- Android 8.0 Oreo (API 26)
- Android 8.1 Oreo (API 27)

Automated and manual testing will be carry out to support different version listed to ensure portability always (Arbuckle, 2017).

### **Reliability requirement**

The term reliability could be referring to as the ability for a software or mobile application component to consistently perform according to its specifications.

#### **2.2.3 Objectives:**

The main objectives of reliability requirements are to:

- Ensure that all aspect of the application function perfectly for long periods without any failure.
- Minimising any unintentional disruptions during operation (E.G, unscheduled downtime).

##### **2.2.3.1 Measurements:**

The reliability requirements basic specification in terms of the below measurements:

- The mean time between failures (MTBF), MTBF can be defined as the estimated elapsed time between built-in failures system during operation.
- The maximum accepted number of failures per unit time.
- The maximum permitted probability of the failure during a given time period.

##### **2.2.3.2 Crash Tolerance:**

Crash tolerance is the ability of a system to ensure predetermined properties despite the occurrence of one or more unpredictable crash failure. Crash can be managed through

data backup, which prevents catastrophic loss of information while using the system.

#### **2.2.3.3 Maintainability requirement**

From security prospective there are many black hat hackers in the current time. One of the goal is to develop an application that not only completes its intended functionality with ease but also impresses and exceeds users' expectations. Where the application happens to fall in terms of performance, functionality or it needs to be updated, several key aspects will be taking to help maintain the application and to help security:

- **Defects/Vulnerability:**

This involves as a developer that reviewing the area of concern for possible abnormalities and addressing them appropriately. If there is an update or new installation in methods. This should not affect user information in database setting both personal or private record in workout section or the food calories activities of the application.

- **Code Quality:**

Looking over the existing code where there lies a potential problem and either patch or improve it.

- **Reducing Redundancy:**

To make the application easy to understand and to make sure that two pieces of code are not doing the same thing, the aim is to eliminate redundancy altogether, assisting in maintaining the steadiness of the overall system.

#### **2.2.3.4 Extendibility requirement**

The system shall be extensible which mean that developers can add more functionality in the system or make update on the exist code without major changes or changing the architecture of the system. The database mechanism shall be design and implemented to be fully extensible, if it ever happened to need further functionality added throughout the development process. The Quiz section of the application was added late to MHWSS system architecture to facilitate a fun and engagement way to user to test their knowledge on mental health that is an example.

#### **2.2.3.5 Reusability requirement**

Reusability is a valid requirement for all projects that involve software development. The application will aim to have multiple functions and other code that can

be re-used and implemented into further or new developments going forward or indeed when creating something new. Reusability is an important factor and requirement as applications in the real world are based hugely on re-used code. The goal is to develop unique code that can be understood and that am comfortable implementing into new environments. The login/registration system is a prime example of this, the vast majority of mobile application with user interaction require user login. The database which will be implemented and connected should be flexible and reusable with other applications where some type of information is being stored.

#### **2.2.4 System Evolution**

To make this application evolve over time the design application has to be flexible, making sure unnecessary and difficult-to-understand code does not exist within the development process. Then it's possible to have innovative, something that is not easily achieved but possible.

#### **2.2.5 Module Description**

##### **2.2.5.1. Introduction**

The Mental Health and Well-being Surveillance System (MHWSS) module is a comprehensive and technology-driven system designed to proactively monitor and address mental health concerns, particularly in adults. It uses a multi-pronged approach involving data collection, analysis, intervention, and collaboration to achieve this goal.

##### **2.2.5.2. Module Objectives**

- **Early Identification:** The primary objective is to identify adult at risk of developing mental health problems at an early stage, enabling timely interventions and preventing escalation of issues.
- **Improved Outcomes:** Early intervention is crucial for improving mental health outcomes and reducing the long-term burden of mental illness.
- **Data-Driven Approach:** The MHWSS leverages data science to gain deeper insights into mental health trends and inform evidence-based decision-making for prevention and intervention strategies.



- **Stakeholder Collaboration:** The module fosters collaboration between parents, educators, and mental health professionals by providing a secure platform for communication and coordinated care plans.

#### 2.2.5.3. Module Functionalities

- **Secure User Management:**
  - User registration with secure login credentials and multi-factor authentication (optional).
  - Role-based access control to ensure user privacy and data security.
  - Secure data encryption at rest and in transit.
- **Multi-Source Data Collection:**
  - Standardized surveys and questionnaires for adults (age-appropriate), parents, and educators.
  - Integration with electronic health records (EHR) systems (with patient consent).
  - Social media data collection (anonymized and privacy-compliant).
  - Wearable technology data (with opt-in consent and data anonymization).
- **Advanced Data Analytics:**
  - Machine learning algorithms to identify patterns and trends in mental health indicators.
  - Risk assessment models to predict potential mental health issues.
  - Data visualization tools for user-friendly exploration of trends and patterns.
- **Communication and Collaboration Platform:**
  - Secure communication channels for parents, educators, and mental health professionals.
  - Real-time data sharing and case management tools for coordinated care planning.
  - Educational resources and training materials for stakeholders.
- **Evidence-Based Interventions:**
  - Integration with a library of evidence-based interventions tailored to specific needs.
  - Online resources and mobile applications for self-management and skill development.

- Referral pathways to connect with qualified mental health professionals.
- **Reporting and Monitoring:**
  - Automated generation of reports for stakeholders on mental health trends and risk factors.
  - Customizable dashboards for monitoring individual cases and progress.
  - Data anonymization to ensure individual privacy in reports.

### 2.2.6 Target Users

- **Adults (Primary Focus):** The MHWSS primarily caters to adults's mental health needs by collecting data and providing appropriate interventions.
- **Parents:** Parents play a crucial role in early identification and can access resources and support through the MHWSS.
- **Educators:** Educators are well-positioned to observe adults's behavior and can utilize the MHWSS for early intervention and communication with parents or professionals.
- **Mental Health Professionals:** The MHWSS supports mental health professionals by providing data-driven insights, facilitating communication, and streamlining care coordination.
- **Public Health Officials:** Public health officials can leverage anonymized data from the MHWSS to gain insights into population-level mental health trends and inform public health interventions.

### 2.2.7 Data Security and Privacy

- **Data Encryption:** All sensitive user data is encrypted at rest and in transit using industry-standard protocols.
- **Secure Data Storage:** Data is stored in secure cloud environments with access controls and intrusion detection systems.
- **User Consent:** Informed consent is obtained from users before collecting data, particularly from wearable technology.
- **Data Anonymization:** Data used for reporting and analysis is anonymized to protect individual privacy.

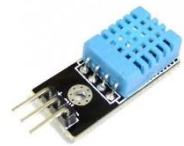
- **Regular Security Audits:** Regular security audits are conducted to identify and address potential vulnerabilities.

## 2.3 Hardware Requirements:

### 2.3.1 Data collection devices:

#### 1. DHT11:

- The DHT11 sensor is primarily used for measuring temperature and humidity levels.
- A Digital Humidity and Temperature (DHT) sensor can play a significant role in a mental health and wellbeing surveillance system by providing environmental context to physiological and behavioural data.



#### 2. Accelerometer Sensor:

- Accelerometer is a sensor which measures the moment patterns and activity levels of a person.
- **Sleep Monitoring**
- **Behavioural Analysis**
- **Physical Health Correlations.**



#### 3. Air quality sensor:

- Air quality sensors can indirectly contribute to mental health assessment by providing insights into environmental factors that may impact psychological well-being.
- Gives information on environmental influence on a person.



- #### 4. Noise Sensor:
- Noise sensors can play a significant role in mental health and well-being surveillance systems through various applications and benefits. Here are some key uses:

- **Noise Pollution:** Continuous exposure to high noise levels is a known stressor and can lead to mental health issues such as anxiety, depression, and sleep disturbances.



Noise sensors can monitor and record noise levels various environments (homes, workplaces, urban areas) to identify problematic areas.

#### 5. Pulse sensor:



- The Pulse sensor is a device designed to measure heart rate and pulse rate in real-time
- **Stress Monitoring**
- **Anxiety Detection**
- **Emotion Regulation**

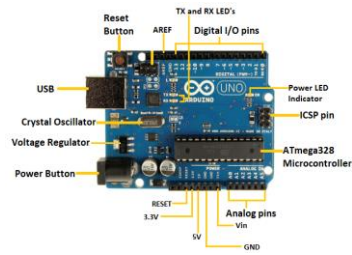
### 2.3.2 Data Transmission:

#### 1. ESP 8266:



- **Wireless Connectivity:** Node MCU's built-in Wi-Fi capabilities allow it to transmit collected data to cloud services, mobile apps, or other devices in real-time.
- **Remote Monitoring:** It enables remote monitoring of physiological parameters (like heart rate) by sending data over the internet to healthcare providers or caregivers.

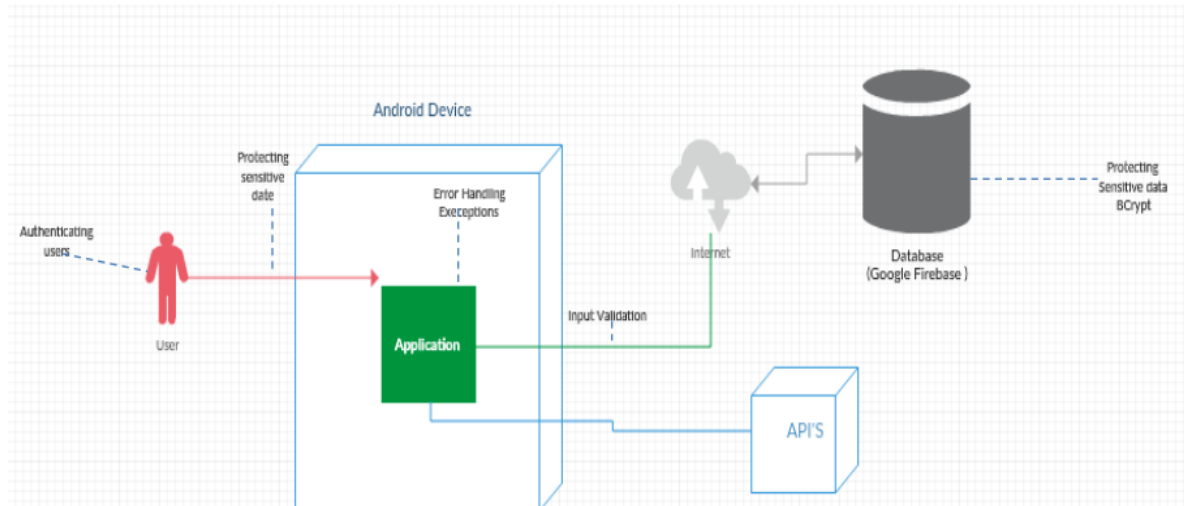
#### 2. Arduino UNO:



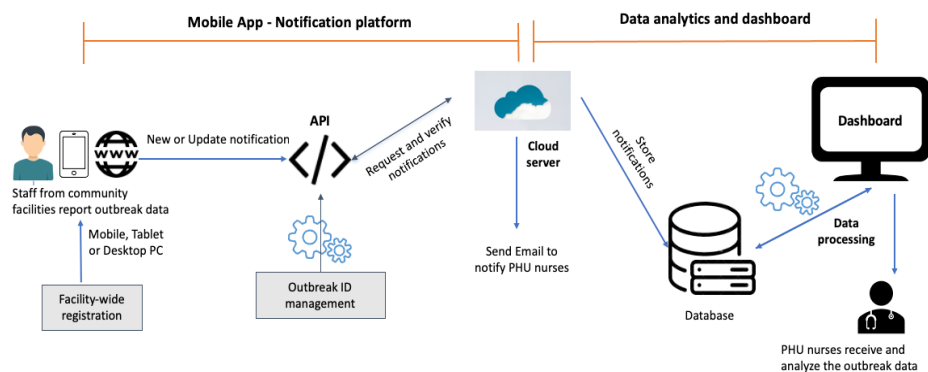
- Arduino UNO is a microcontroller board .
- It has 14 digital input/output pins and 6 Analog pins.
- Arduino Uno can interface with various sensors to collect physiological data.

### 3.DESIGN MODELING FOR MHWSS

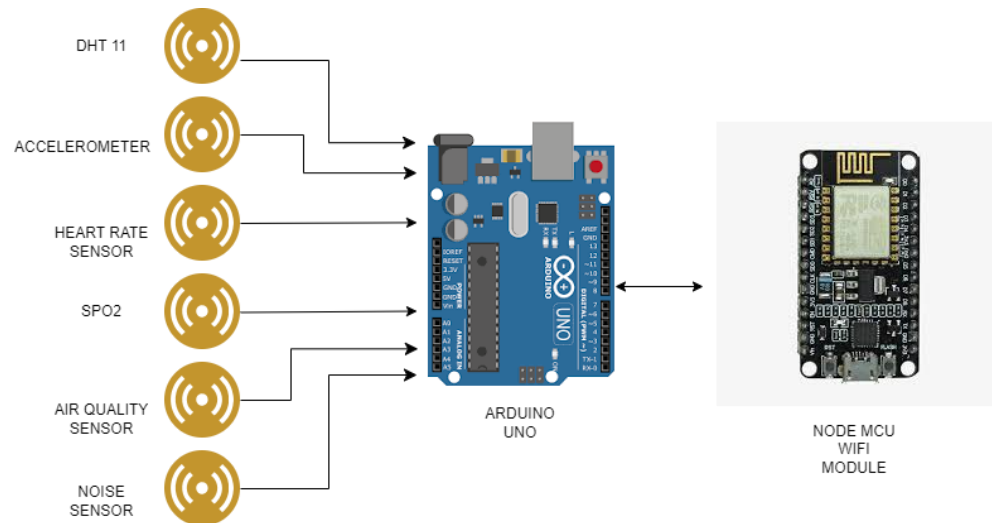
#### 3.1 System Architecture



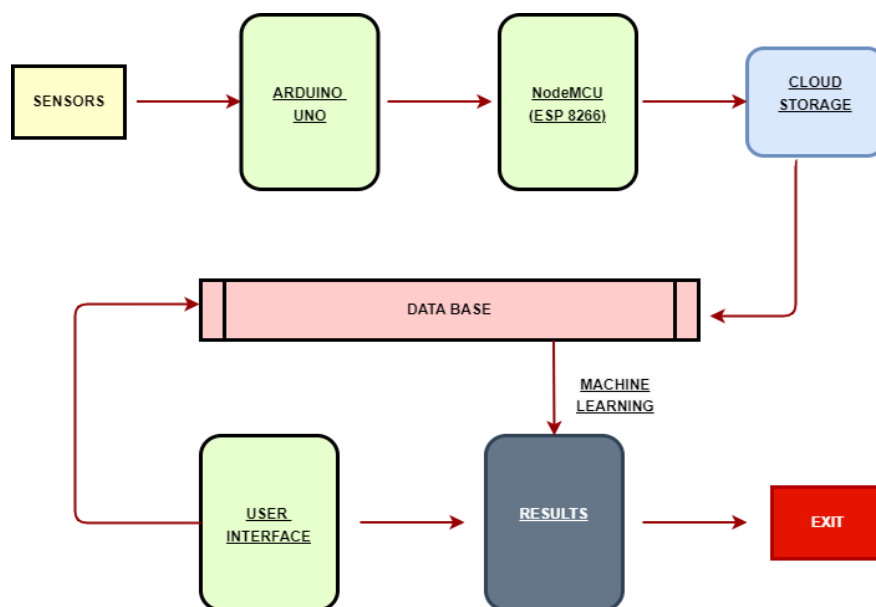
Above is the system architecture of MHWSS application. The application is hosted locally on a device running Android OS. The Secure System Architecture above shows all the components the system was made off after development. This architecture was chosen because of its simplicity and also separating all the major components which allows better maintainability and flexibility MHWSS system application. The architecture employs security throughout the system as shown (Software, 2015). The application is hosted locally on a device running Android Operation system. Google Firebase is the database that was used to store user credential and logging. MHWSS application also uses some API services.



### 3.2 Circuit diagram:

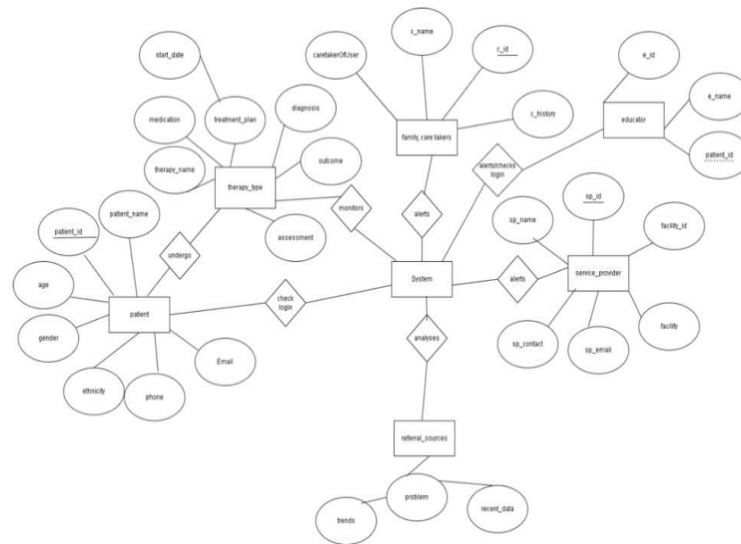


### 3.3 Work flow:



### 3.4 ER DIAGRAM

ER diagrams are essential tools in database design, aiding in the conceptualization and organization of data structures. They help in understanding the data model and defining the structure of a database system before its implementation. The entities represent real-world objects or concepts, while the relationships denote how these entities are connected or associated with each other. By providing a clear visualization of the data model, ER diagrams facilitate better understanding and communication among stakeholders involved in the database design process.



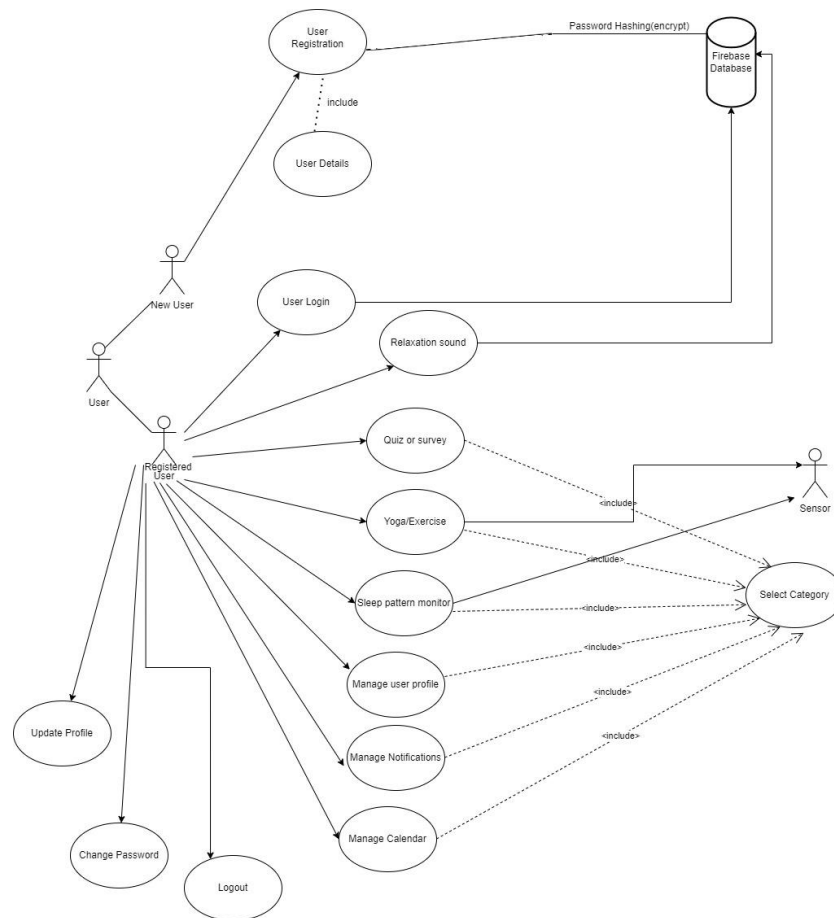


### 3.4.1 DATA DICATIONARY

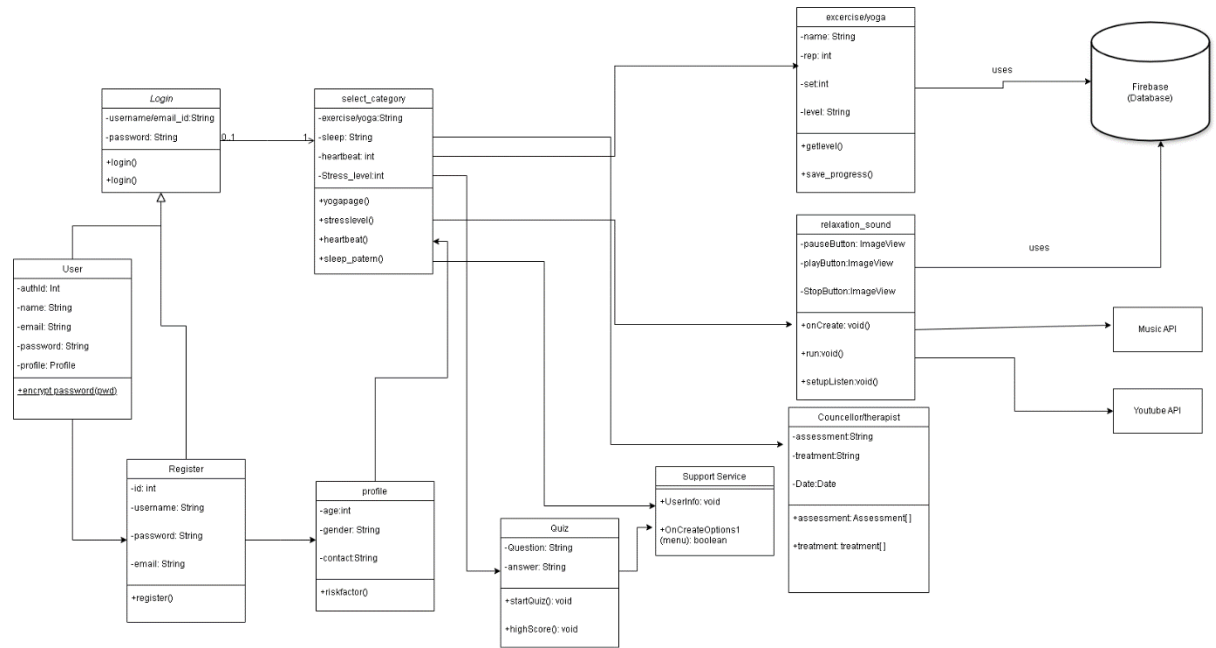
Name	Description	Type	Date
Patient_ID	Unique identifier for each patient	Attribute	04/27/2024
Age	Age of the patient	Attribute	04/27/2024
Gender	Gender of the patient	Attribute	04/27/2024
Ethnicity	Ethnicity of the patient	Attribute	04/27/2024
Diagnosis	Primary mental health diagnosis	Attribute	04/27/2024
Treatment_Plan	Recommended treatment plan for the patient	Attribute	04/27/2024
Assessment_Score	Score from mental health assessment	Attribute	04/27/2024
Medication	Medications prescribed for the patient	Attribute	04/27/2024
Therapy_Type	Type of therapy recommended for the patient	Attribute	04/27/2024
Service_Provider	Health provider delivering services to the patient	Attribute	04/27/2024
Assessment_Date	Date of the mental health assessment	Attribute	04/27/2024
Treatment_Start	Date when the treatment plan starts	Attribute	04/27/2024
Treatment_End	Date when the treatment plan ends	Attribute	04/27/2024
Intervention	Interventions taken to address mental health	Attribute	04/27/2024
Monitoring_Frequency	Frequency of monitoring mental health status	Attribute	04/27/2024
Outcome	Result or status of the mental health treatment	Attribute	04/27/2024
Provider_ID	Unique identifier for the healthcare provider	Attribute	04/27/2024
Facility_ID	Unique identifier for the healthcare facility	Attribute	04/27/2024
Referral_Source	Source of referral for mental health services	Attribute	04/27/2024

### 3.5 UML DIAGRAMS:

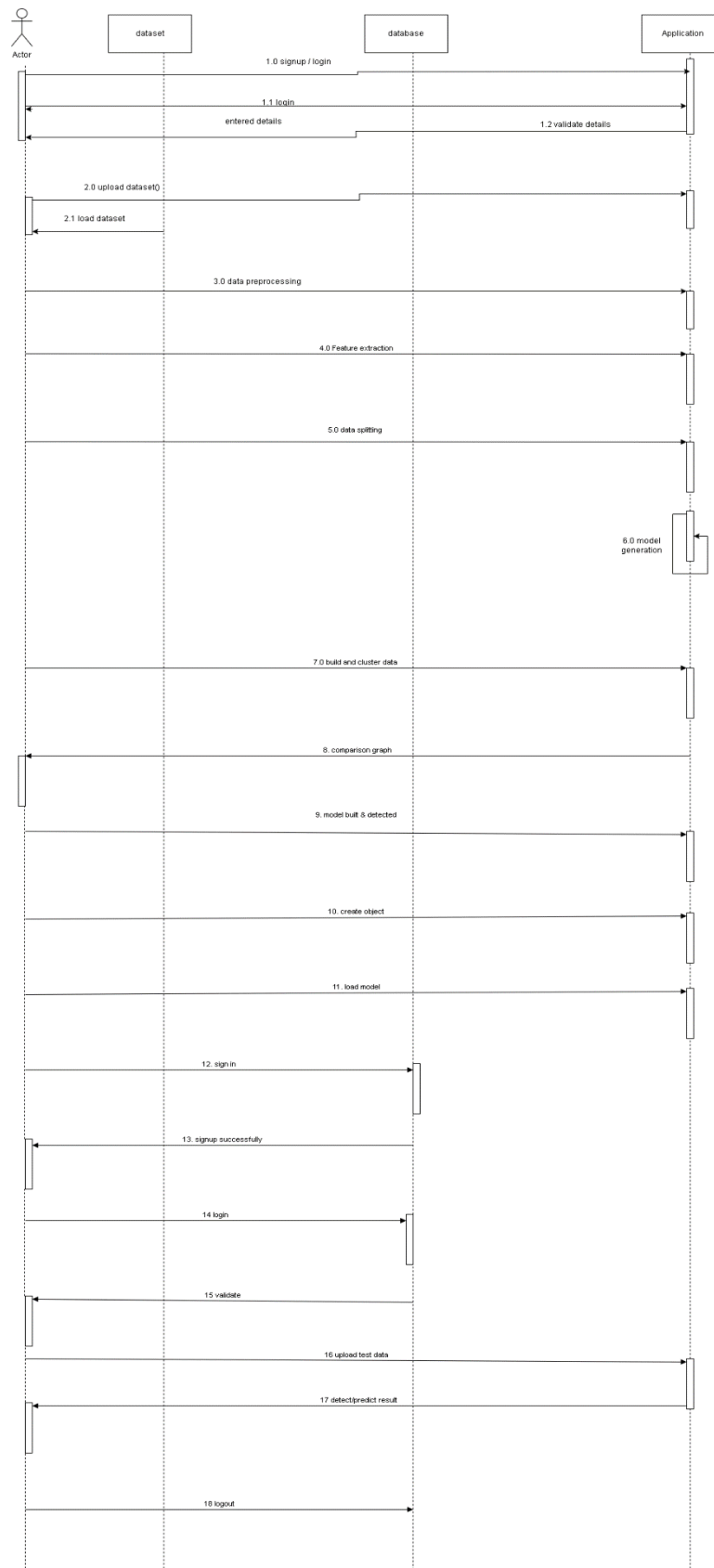
#### 3.5.1 Use Case Diagram:



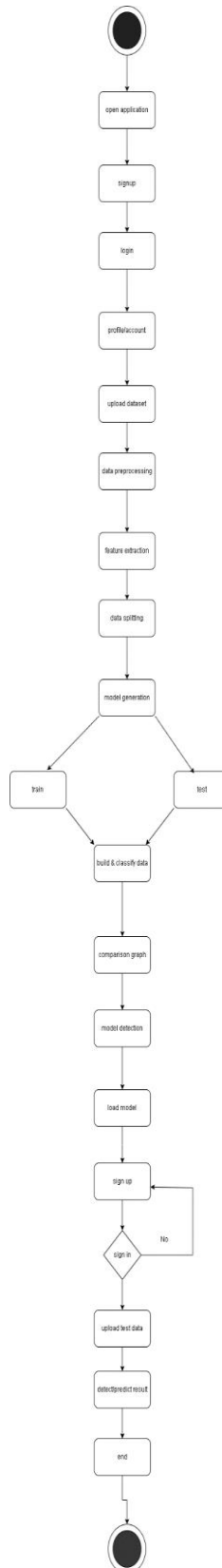
### 3.5.2 Class Diagram:



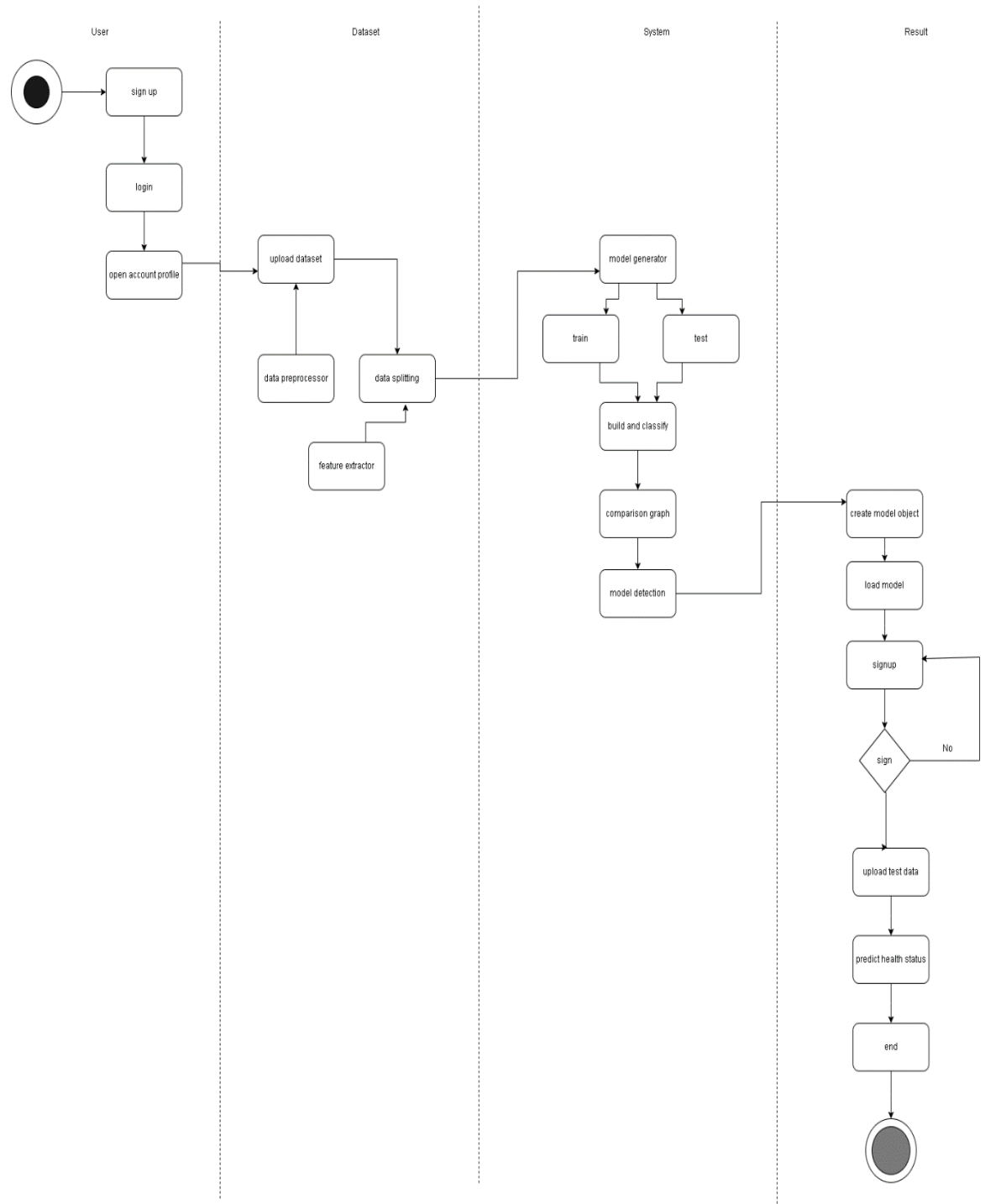
### 3.5.3 Interaction Diagram:



### 3.5.4 State Chart Diagram:

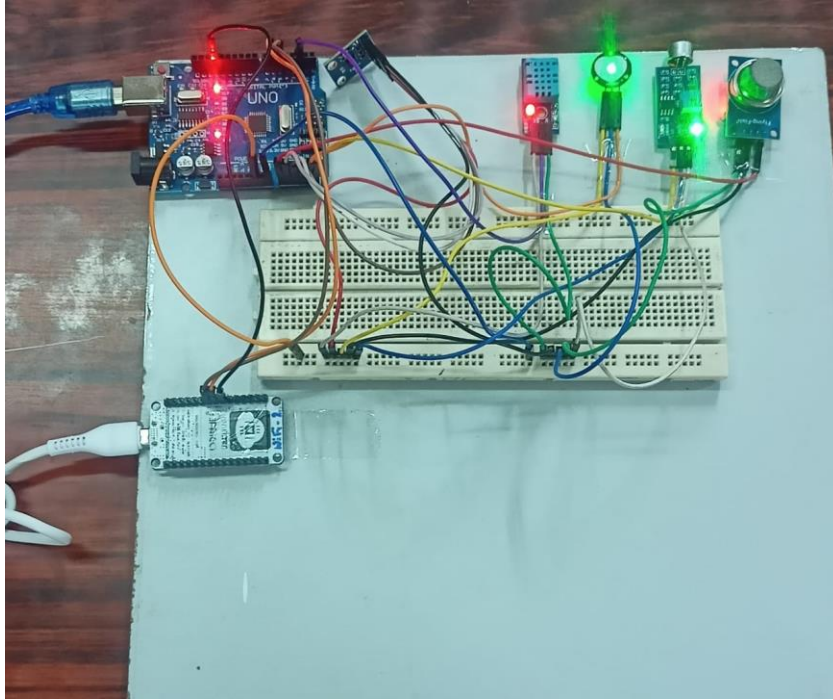


### 3.5.5 Activity Diagram:



## 4. RESULT AND CONCLUSION

### 4.1 Prototype:



Setup for a mental health and wellbeing surveillance system involves using an Arduino and a NodeMCU to collect and transmit data from various sensors to Firebase. Sensors gather data, which is processed by the Arduino. The processed data is then sent via serial communication to the NodeMCU, which handles the Wi-Fi connection and transmits the data to Firebase for storage and analysis. This system allows for real-time monitoring and data collection, providing valuable insights into various parameters related to mental health and wellbeing. Such a setup can be useful for continuous health monitoring and proactive wellbeing management.

## 4.2 Firebase:

<https://mental-health-50dc3-default-rtdb.firebaseio.com> > UsersData > BckGr670JxVb... > readings

X: "354.00"

Y: "416.00"

Z: "344.00"

air: "4.97" 

humidity: "70.00"

noise: "71.00"

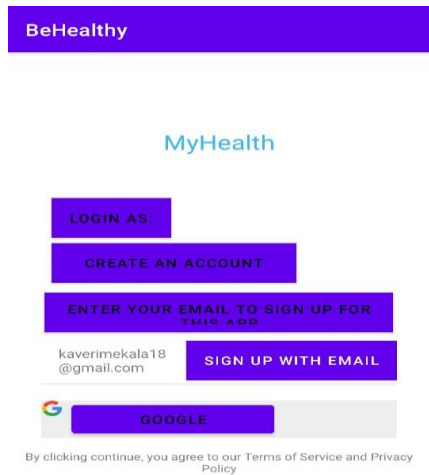
pulse: 78.00 ABC ▼

×

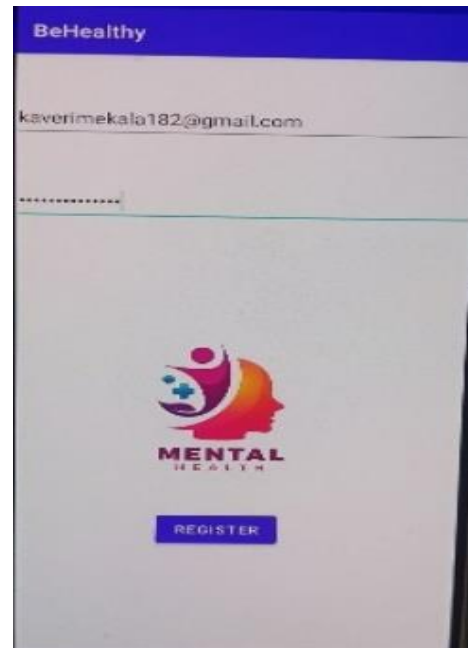
temperature: "30.80"



## 4.3 User Interface



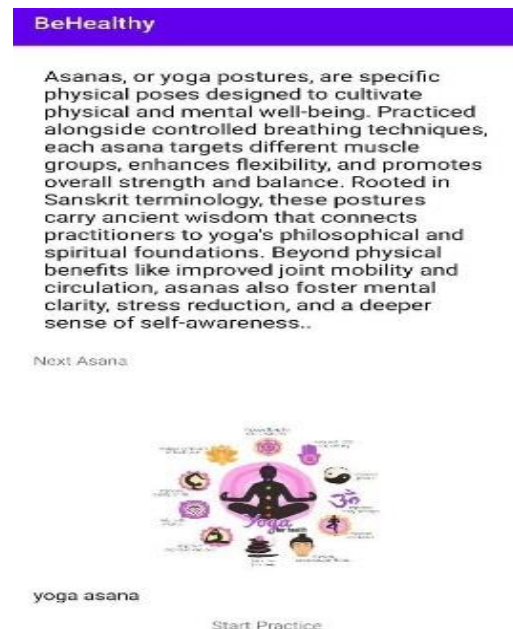
Login Screen: The login interface of the BeHealthy app, providing options to log in, create an account, or sign in with Google.



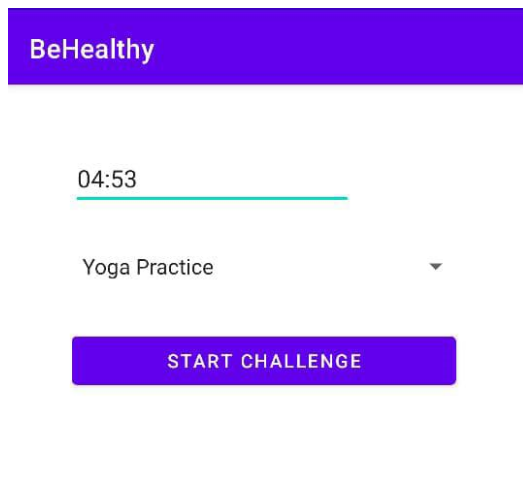
Registration Screen: The registration page for new users, requiring an email address for account creation.



Main Menu: The main navigation menu of the BeHealthy app, offering various options like starting workouts, challenges, instructional activities, and accessing support services.



Yoga Practice Information: An informational screen detailing the benefits and practices of yoga, promoting physical and mental well-being.



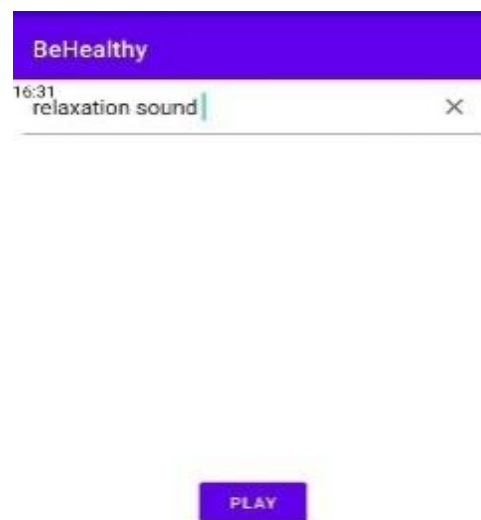
Start Challenge: The interface for starting a new challenge, showing a timer and activity selection.



Disclaimer: shows the instructions.



Health Tracking Report: The health status of the user



Relaxation Sound: A search and play interface for finding and playing relaxation sounds



BeHealthy

Idli

300

SAVE CALORIES

This is a mockup of a 'Calorie Entry' screen. It features a blue header with the text 'BeHealthy'. Below the header is a text input field containing the word 'Idli'. Underneath the input field is a green horizontal line, and below that, the number '300' is displayed. At the bottom of the screen is a blue button with the text 'SAVE CALORIES'.

BeHealthy

CALL SUPPORT

Calorie Entry: A screen for logging calorie intake

Support Call: A button to call support services for assistance.

## 4.4 Conclusion & Future Considerations:

### Conclusion:

A mental health surveillance system aims to improve mental health outcomes by monitoring and analyzing data to enable early detection, prevention, and management of issues. It provides personalized care, data-driven insights, and resource optimization. The system empowers individuals through self-monitoring and timely interventions. Key challenges include ensuring data privacy and security, maintaining accuracy, integrating with existing healthcare systems, and addressing ethical concerns. Proper implementation promises enhanced mental health strategies, better resource allocation, and improved quality of life.

### Future Scope & Considerations:

- **Reducing Stigma:** The potential impact of the MHWSS on reducing mental health stigma should be further explored and integrated into the system's functionalities.
- **User Feedback Integration:** The MHWSS should incorporate mechanisms for collecting user feedback and utilizing it to continually improve the system's effectiveness and user experience.
- **Scalability and Sustainability:** The MHWSS should be designed for scalability to accommodate a growing user base and ensure long-term sustainability through efficient resource allocation and ongoing maintenance.
- **Developing wearable devices and chatbot**

## 4.5 Bibilography

- Mental health surveillance among children—United States, 2013–2019 Rebecca H Bitsko MMWR supplements 71, 2022 Public Health Surveillance for Mental Health
- January 2010 Preventing Chronic Disease 7(1):A17 January 2010 7(1):A17 Source Pub Med License CC BY 4.0 Authors: Elsie J Freeman Lisa J Colpe U.S. Department of Health and Human Services Tara Strine Centers for Disease Control and Prevention Satvinder Dhingra Centers for Disease Control and Prevention
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