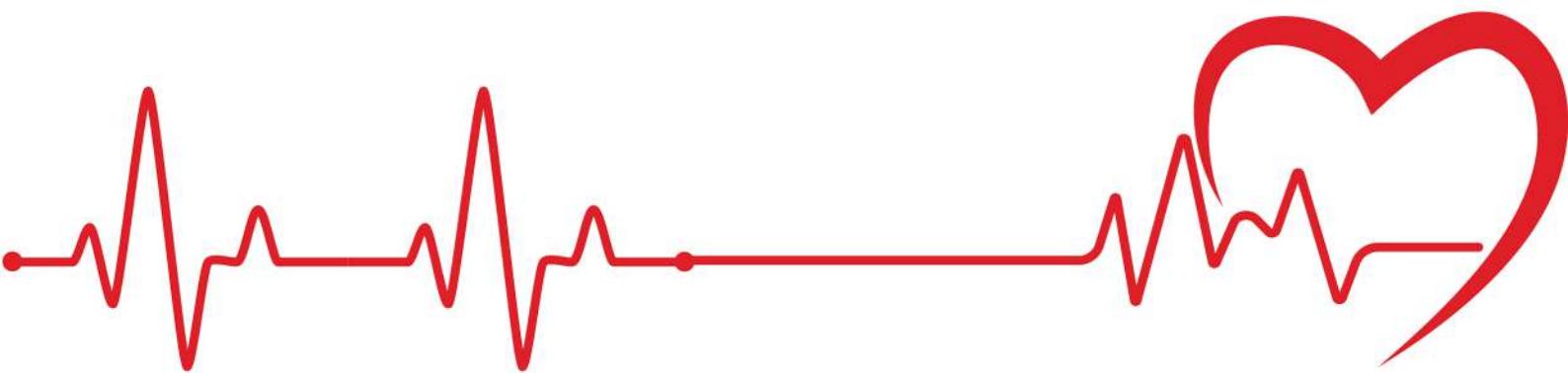




INTERNSHIP REPORT

As member of technical staff,
Devops Team

26-05-2023 to 01-07-2023



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ACKNOWLEDGEMENT

I would like to express my sincere gratitude to Mr. Ravi Bhogu and Mrs. Aparna Bhogu, for their invaluable guidance throughout my internship.

I am deeply indebted to Mr. Sashank Bhogu, whose mentorship has been instrumental in my professional growth. His expertise and willingness to share his knowledge have broadened my horizons, introducing me to cutting-edge technologies and imparting invaluable skills in the field of development. I am truly grateful for his patience, kindness, and continuous guidance throughout this journey.

I would also like to acknowledge the support and encouragement provided by Mr. Srikanth Seesham and Mr. Praneesh Gore. I would also like to extend my heartfelt appreciation to Ms. Zeba Parveen, the HR representative, for her constant support and assistance during my internship.

Furthermore, I would like to extend my gratitude to all the team members at Monitra Healthcare. Their collaborative spirit, dedication, and willingness to assist have fostered a great sense of camaraderie within the team.



PURPOSE

After completing my second year of college, I eagerly looked forward to utilizing the semester holidays to gain practical industry experience and apply the skills I had developed thus far.

As someone with aspirations of building my own startup in the future, I was particularly keen on immersing myself in the startup culture. With this goal in mind, I applied for an internship at Monitra Healthcare, a healthcare startup, and was thrilled to be accepted.

This opportunity allowed me to delve into the world of entrepreneurship while simultaneously contributing to the growth of the company.

Being in the healthcare space not only provided me with a chance to experience the dynamic world of startups, but it also instilled in me a deep sense of commitment and responsibility. Moreover, my longstanding interest in medical sciences was further fueled as I witnessed firsthand the impact that innovative solutions can have on improving people's lives.



About Monitra Healthcare

Monitra Healthcare started with a fundamental premise that healthcare monitoring should not be cumbersome for patients.

As a team of passionate individuals on a mission to help clinicians in early accurate diagnosis of medical conditions with simple cutting-edge innovations, Monitra Health seeks to address the world's pressing health problems using medical data driven insights to shape healthcare delivery.

Their product, upBeat®, helps clinicians diagnose two most difficult problems in clinical cardiology - unexplained fainting & palpitations.

The company's mission is to help clinicians in early accurate diagnosis of medical conditions with simple cutting-edge innovations.





About the product UpBeat

upBeat is a wearable medical grade biosensing skin patch that continuously 24x7 captures electrocardiogram (ECG) and tracks posture as well as activities in real-time. This physiological data is transmitted continuously to the phone and the information is relayed to the cloud platform, upBeat®.AI

It has the most advanced biosensors which makes remote monitoring easy for patients with unexplained palpitations & transient loss of consciousness. UpBeat's dashboard allows for structured efficient review of entire data and generation of reports thereby facilitating actionable diagnosis.

Some of the features include :

- No wires, slim profile, discreet, can be worn for up to 7 days
- Logs symptoms, receive data from biosensor & relays to upBeat® data lake
- To document arrhythmia where symptoms occur infrequently
- 24/7 access to patient data, history and reports
- Customised event alerts for each patient
- Personalised reports to meet your needs.

KNOWLEDGE AND SKILLS

1. HTML, CSS, JAVASCRIPT - I was amazed by the power and versatility of JavaScript, which allowed me to enhance the interactivity and dynamic behavior of web pages. Learning how to manipulate HTML and CSS elements using JavaScript opened up a whole new world of possibilities in web development.
2. VUE JS - I had the opportunity to be introduced to and work with Vue.js, a progressive JavaScript framework. I was impressed by its simplicity and efficiency in building interactive user interfaces.
3. D3 JS - Exploring D3.js, a JavaScript library for data visualization, was a fascinating experience. I learned how to create stunning and interactive graphs and visualizations using D3.js. It allowed me to represent complex data in a visually appealing manner, making it easier for users to interpret and understand the information.

KNOWLEDGE AND SKILLS

4. Graph creation using canvas - Working with the HTML5 canvas element to create graphs was an exciting challenge. I acquired the skills to dynamically generate graphs and charts using canvas, allowing me to customize their appearance and behavior.
5. Functionality creation - Throughout my internship, I gained hands-on experience in creating various functionalities for my application. Understanding how to build robust and user-friendly functionalities was a key takeaway from my internship.
6. Resource collection and utilization - I learned the importance of using the right resources from the abundant ones present while developing my project. This involved efficient handling of data, minimizing network requests, and choosing right resources from the web . I was able to create an application that were fast, responsive, and scalable.

KNOWLEDGE AND SKILLS

7. Time management - Managing my time effectively became crucial during my internship. I learned to prioritize tasks, set achievable deadlines, and allocate time efficiently. This skill enabled me to meet project milestones and deliver work within the given timeframes.
8. Workspace culture - Being part of a professional workspace provided me with valuable insights into workplace culture. I learned how to communicate effectively, collaborate with team members, and adapt to the company's work environment. Embracing a positive and inclusive workspace culture enhanced my overall internship experience.
9. Presentation skills - As part of my internship, I had the opportunity to present my work to my colleagues. This allowed me to improve my presentation skills, both in terms of content delivery and visual aids. I learned how to effectively communicate complex technical concepts to diverse audiences, further enhancing my ability to convey ideas with clarity and confidence.



MY PROJECT

PROJECT TITLE : LIVE ECG GRAPH

ABOUT :

During my internship, my project involved developing a live ECG graph feature. My primary task was to collect real-time data from patients wearing an implanted device and plot their ECG graphs on grid paper. This innovative feature allowed doctors to monitor their patients' heart activity and make timely observations. By harnessing the power of technology and data analysis, the live ECG graph feature facilitated efficient healthcare monitoring.

FEATURE REQUIREMENT :

Graph Performance :

1. Smooth Performance on Mobile and Desktop Devices :
The animation of the live graph should be seamless and free of any jerky movements, providing a smooth user experience across both mobile and desktop devices.



MY PROJECT

2. Scalable Graph :

The ECG Live Graph should be scalable, allowing users to zoom in or out to examine specific sections of the graph in more detail or to get an overview of a longer time span.

Responsive Design :

The ECG Live Graph should adapt and adjust its layout to fit different screen sizes, ensuring optimal visibility and usability on various devices.

Background ECG Grid :

The ECG Grid specifications are as follows:

1. Speed: 25 mm / sec
2. Amplitude: 10 mm / mV



MY PROJECT

Reactivity:

Reactive behavior on changing the Rental ID :

When the Rental ID changes, the previous graph should be promptly removed, and a new graph should be generated for the current session ID.

Dynamic rendering of the live graph for a sense of continuity :

The transition between graphs should be seamless and visually appealing.

Continuous Data Collection:

The live graph should continually gather fresh data at regular intervals and dynamically update the graph, creating a sense of continuous monitoring and real-time visualization.

Dynamic rendering of the live graph for a sense of continuity



MY PROJECT

Time Axis:

Display the timestamp of the ECG data :

The time axis should display the timestamp of the ECG data, allowing users to track the progression of the recorded ECG over time.

Time synchronous nature of the graph

Customizable Display Options:

Provide options for customizing the graph's appearance :

Users should have the ability to customize the appearance of the live graph, including color schemes, line styles, and marker types, allowing for personalization and better visualization based on individual preferences.

Data Export and Storage Support in common formats :

The ECG Live Graph should support data export and storage functionalities, allowing users to save or download the recorded ECG data



MY PROJECT

User-friendly Interface:

Intuitive with clear navigation controls and tooltips making it easy for users to interact with and understand the various features and functionalities provided.

DEVEOPMENT:

Retrieving the data :

I had to fetch ECG (Electrocardiogram) data from a server API for a specific rental identified by the 'iRentalID' parameter. The function starts by converting the 'iRentalID' to a string and constructs a URL with the rental ID as a query parameter. The code then creates an XMLHttpRequest object to make an HTTP GET request to the server using the constructed URL.

The function sets up an 'onreadystatechange' event handler to listen for changes in the ready state of the XMLHttpRequest.



MY PROJECT

When the ready state becomes 'XMLHttpRequest.DONE', the code checks if the status of the response is 200, indicating a successful request. If it is, the response text is parsed as JSON and assigned to the 'myJSON' variable.

Once the XMLHttpRequest is sent, the function returns the 'myJSON' variable and calls the 'callback' function.

The purpose of the callback function is to handle the retrieved data or perform additional actions after the ECG data retrieval is complete.

Using VueJS:

1. The Vue app is defined with the 'el' property set to '#app' to target the corresponding HTML element.

2. The Vue app uses Vuetify for the visual components and initializes it with 'new Vuetify()'.



MY PROJECT

3. The data section of the Vue app includes the `selectedValue` variable to store the currently selected Rental ID, the `options` array to provide the available rental options.
4. The `drawLiveGraph` method is defined, which is triggered when the selected value changes. It takes the selected Rental ID as a parameter ('iRentalIDStr') and converts it to an integer ('iRentalID').
5. The method then calls the `drawGraph` function, passing the selected Rental ID as a parameter, to draw the graph using the fetched ECG data.
6. Finally, the method returns the selected Rental ID.

The Vue app also includes the necessary HTML markup using Vuetify components to display the graph, provide a selection dropdown for the Rental IDs, and a button to download the CSV file.



MY PROJECT

The data export feature:

The code includes a 'downloadCSV' function that enables the export and storage of data as a CSV file. It takes the selected rental ID and the ECG data as inputs. The function converts the JSON data into CSV format by iterating over the data and extracting the necessary fields like date, time, voltage, and PosixMs. It then creates a download link for the CSV file, simulates a click on the link, and triggers the download process. This feature allows users to easily export and save the ECG data in a CSV file for further analysis or storage purposes.

Array manipulation:

There are three arrays used for storing and passing data: 'vData', 'iData', and 'data'.

- 'vData' is used to store the raw ECG data retrieved from the 'ECGData' function. It contains the complete dataset for the specified rental ID.



MY PROJECT

1- `iData` is created by extracting the ECG values from `vData` and storing them in a separate array. This array is used for processing and plotting the graph.

- `data` is the main data array used for rendering the graph on the canvas. It represents the sliding window of 1600 data points that are currently visible on the graph. By separating the data into different arrays, the code allows for efficient data manipulation and ensures that only the necessary data is processed and displayed on the graph, improving performance and memory management.

Responsive design using media queries:

1. Media queries are used to make the graph responsive and adapt to different screen sizes and orientations.
2. By utilizing media queries, the graph was optimized for mobile devices in both portrait and landscape modes, as well as tablets and desktop devices.
3. Media queries allowed for a better user experience



MY PROJECT

Canvas creation:

1. Canvas was chosen for graph drawing because it provides a powerful and flexible platform for rendering dynamic and interactive graphics directly in the browser.
2. Creating a canvas involves setting up a drawing context and manipulating it using JavaScript.
3. The canvas element provides a pixel-based drawing surface, enabling precise control over every element of the graph's appearance and behavior.
4. By leveraging the canvas API, the drawGraph function can dynamically update the graph with new data points and provide a smooth and responsive visual representation of the ECG data.

Using the d3js library:

The d3.js library is used to facilitate data visualization and manipulation tasks within the project.



MY PROJECT

It is primarily employed for creating and managing scales, which map data values to the appropriate positions on the graph.

The library provides the `d3.scaleLinear()` function, which is utilized to define the x and y scales for the graph, mapping the data range to the corresponding visual range on the canvas.

These scales ensure that the data points are appropriately positioned and scaled within the graph area.

Additionally, d3.js is used to draw the line representing the ECG data.

The `d3.line()` function is employed to generate a path based on the provided data points, and the resulting line is then rendered on the canvas using the `context.stroke()` method.

Overall, d3.js simplifies the process of handling data and generating visual elements, allowing for efficient and customizable graph creation.



MY PROJECT

Grid lines and caching :

The concept of creating a grid and caching the image is employed to optimize the rendering process and improve efficiency. The grid lines are essential for providing a visual reference and aiding in the interpretation of the ECG graph. Instead of drawing the grid lines directly on the canvas every time the graph is updated, the code first generates the grid lines on an off-screen canvas using the `cacheGridLines()` function. This off-screen canvas is created and stored during the initialization phase, ensuring that the grid lines are drawn only once.

By caching the grid lines, the code eliminates the need to redraw them on every frame update, significantly reducing the computational overhead. When rendering the graph, the cached grid image is simply copied onto the visible canvas using the `context.drawImage()` method.



MY PROJECT

This process is much faster than redrawing the grid lines from scratch for each frame, leading to improved performance and smoother graph rendering.

Additionally, the code incorporates a level of customization by including different line colors and spacing options for the grid. The grid lines are divided into larger boxes and smaller boxes, distinguished by different colors.

Grid lines are drawn in the dimensions as learnt according to standard measurements to have 8sec worth in the X axis and 4mV worth in the Y axis.

The requestAnimationFrame functionality :

The requestAnimationFrame concept is utilized in the given code to create a smooth and efficient animation loop for updating and rendering the graph.



MY PROJECT

It is a browser API that allows for synchronized, high-performance animation rendering by utilizing the browser's rendering engine.

In the code, the animation loop is initiated by calling `requestAnimationFrame` with a callback function that performs each iteration of the loop. This callback function is executed by the browser before the next repaint, ensuring optimal timing for rendering updates. The callback receives a timestamp parameter indicating the current time when it is called.

The loop iterates over the available data points and updates the graph accordingly. By leveraging `requestAnimationFrame`, the loop is synchronized with the browser's rendering cycle, ensuring smooth animation and reducing the risk of dropped frames or performance issues.



MY PROJECT

Looping the graph - the most challenging part of the project:

I created a looping mechanism for processing and updating the graph with data. The loop iterates through the available data points and gradually renders them on the graph canvas.

The 'executeBatch' function is responsible for executing a batch of iterations within the loop. It takes a starting and ending index and iterates over the corresponding data points. For each data point, the 'updateGraph' function is called to update the graph based on the current data value. The graph is redrawn, taking into account the new data point and applying the necessary scaling and positioning.

The loop continues to execute batches of iterations until all the data points have been processed.



MY PROJECT

It ensures that the graph rendering is performed incrementally, allowing for a smooth and gradual display of the data. The loop also implements a downsampling rate, adjusting the number of iterations executed per batch to optimize performance and maintain a consistent frame rate.

To ensure a continuous and uninterrupted looping process, the code utilizes the `requestAnimationFrame` API. The animation loop is initiated using `requestAnimationFrame`, which calls the `executelteration` function for each iteration of the loop.

In summary, the looping mechanism in the code efficiently processes and updates the graph by iteratively rendering the available data points. It leverages batch processing, and `requestAnimationFrame` to ensure a smooth and continuous display of the graph, providing a dynamic and interactive visualization of the data.



MY PROJECT

Timestamp updation:

The code includes functionality for updating the timestamp displayed alongside the graph. The 'updateTimestamp' function takes a 'vPosixMs' parameter, which represents the timestamp in POSIX milliseconds. It converts this value into a human-readable format using the 'toLocaleString' method, and assigns the resulting string to the 'newTimestamp' variable. The updated timestamp is then logged to the console and assigned to the 'textContent' property of the 'timestampBox' element, ensuring it is displayed on the webpage. This allows real-time tracking of the timestamp corresponding to the currently displayed data point on the graph.

The batching mechanism:

The code implements a batch method for processing data in a synchronized manner.



MY PROJECT

The `drawGraph` function executes the data processing in batches, with each batch representing a fixed number of iterations defined by the `iterationBatchSize` variable. This approach ensures that the graph rendering and data updates are synchronized, allowing for a smoother and more consistent visualization.

The batch execution is performed using the `executeBatch` function, which takes a start and end index to determine the range of data points to process in each batch. By dividing the data processing into smaller batches, the code achieves better time synchronization and prevents overwhelming the system with a large number of computations at once.

VALIDATION:

Testing and validation of the live ECG Graph took place to check if it is using the standard X and Y axis. I created a sine and cosine wave and passed it into my canvas.



MY PROJECT

The trigonometry formulae were used to formulate a wave with its crests and troughs.

$A\sin(2\pi ft)$

Heart rate - 60 beats per minute

Frequency = $60/60 = 1$

Sampling rate - 200

$A=1$

Creation of a 1mV signal should pass through 4 boxes

All tests passed!

DEPLOYMENT OF FEATURE IN PORTAL:

Using the import and export feature, to the existing Vue App in the doctor's portal, another column called liveGraph was added and my project was plugged in and is LIVE now!



MY PRESENTATIONS

SESSION 1:

DATE - JUNE 27, 2023

TIME - 5PM

VENUE - THE GATHERING INTEL, T-HUB

TOPIC - **THE BASICS OF ECG : Waves, Intervals and Segments**

In the presentation, several key concepts related to electrocardiography (ECG) were discussed. I began by explaining the fundamental processes of depolarisation and repolarisation within the heart's electrical activity. These processes were illustrated using visual aids and simplified diagrams to enhance understanding.

The presentation then delved into the five basic ECG waveforms commonly observed in a standard ECG recording: the P wave, QRS complex, T wave, U wave, and ST segment.



MY PRESENTATIONS

Each waveform was explained in detail, highlighting its significance and the corresponding electrical events occurring in the heart.

Another topic covered was the distinction between ECG segments and ECG intervals. I spoke about the importance of correctly identifying and measuring these intervals for accurate ECG interpretation.

The 5-4-3 Rule was introduced as a mnemonic device to aid in the interpretation of ECG. Finally, the presentation discussed the use of ECG graph paper and its significance in recording and analyzing ECG waveforms. The layout and specific measurements of ECG graph paper were explained, highlighting its role in representing time and voltage accurately.



MY PRESENTATIONS

SESSION 2:

DATE - 01-07-2023

TIME - 12:30 PM

VENUE - THE LEARNING LOFT

TOPIC - ECG LEADS

In the presentation, various aspects of electrocardiography (ECG) leads were discussed. Citing the example of a cricket match and coverage from various angles to know what Virat Kohli and Yuzvendra Chahal are doing, I linked it to how our heart also needs to be covered in the same detail.

I began by explaining the concept of limb (extremity) leads and their role in recording electrical activity from the arms and legs. The orientation and polarity of these leads were emphasized, highlighting how they contribute to the accurate interpretation of ECG waveforms.



MY PRESENTATIONS

The presentation then moved on to discuss chest/precordial leads, which provide valuable information about the heart's electrical activity from different angles.

I explained how these leads are positioned on the patient's chest and the significance of their placement in obtaining a comprehensive ECG assessment.

The need for 12 leads was a crucial topic addressed in the presentation. I outlined the advantages of having multiple leads, including the ability to view the heart's electrical activity from various perspectives and detect specific cardiac abnormalities. We gained an understanding of the specific information each lead provides and how the combination of all 12 leads enhances diagnostic capabilities.



MY PRESENTATIONS

The presentation also touched upon the use of cardiac monitors and monitor leads. I explained how these devices are utilized in clinical settings to continuously monitor a patient's heart rhythm and detect any abnormalities promptly. The importance of proper lead placement and connection to ensure accurate monitoring results was emphasized.

Lastly, I introduced ambulatory ECG technology, which allows for long-term monitoring of a patient's heart activity outside the clinical setting. The benefits and applications of ambulatory ECG were discussed, including the detection of arrhythmias that may not be captured during a standard ECG recording. This is a technology we are very familiar with and make use of in our daily lives.



FINAL TAKEAWAY

My internship has been an incredibly enriching experience, and I owe a great deal of my growth to my mentor, Sashank sir. He introduced me to the concept of using the playground, specifically jsbin, as a tool for experimentation and exploration. By providing a safe space to play with code, I was able to push my boundaries and gain a deeper understanding of JavaScript and its possibilities.

One of the most valuable lessons I learned from Sashank sir was the importance of incorporating console.log or similar print statements into my code. This simple practice enabled me to track the flow of control and identify potential areas for debugging. His suggestion to include a friendly "Hi, I am here" message within the print statements became a helpful marker in pinpointing specific parts of the code.



FINAL TAKEAWAY

During my internship, Sashank sir highlighted the significance of learning Golang for developing large-scale programs. He emphasized its efficiency and speed, underscoring its relevance for future projects. Through his guidance, I recognized the value of expanding my programming language repertoire and set my sights on mastering Golang to tackle complex coding challenges.

The unwavering support and encouragement from Sashank sir instilled in me a never-give-up attitude when it comes to coding and development. He taught me that there is always a solution, even when it may seem elusive at first.

Lastly, Sashank sir introduced me to the power of music and a calm mind in boosting productivity. His emphasis on creating an environment conducive to concentration and mental tranquility inspired me to explore different methods of achieving optimal productivity, whether through music or other relaxation techniques.



FINAL TAKEAWAY

Reflecting on my internship, I am immensely grateful for the abundance of knowledge and growth I have experienced under the guidance of Sashank sir. His mentorship has not only expanded my technical skills but also instilled in me a resilient mindset and the belief that anything is possible with determination and perseverance. Being part of such an exceptional organization and having the opportunity to learn from the entire team has been an invaluable privilege.