MEDIGUARD: REAL-TIME HEALTH MONITORING AND AMBULANCE DISPATCH SYSTEM

Lakshmi. T[1] ,Ganesh.V[2], Gobi. L[3]

[1]Assistant Professor, Department of Artificial Intelligence and Data Science Karpaga Vinayaga College ofEngineering and Technology, Chengalpattu, Tamil Nadu, India.

[2]Assistant Professor, Department of Bio- Chemistry, Karpaga Vinayaga Institute of Medical Science and Research Centre, Chengalpattu, Tamil Nadu, India

[3]Student, Department of Artificial Intelligence and Data Science Karpaga Vinayaga College ofEngineering and Technology, Chengalpattu, Tamil Nadu, India.

ABSTRACT

This design represents an innovative approach to revolutionizing extremity medical services (EMS)through the integration of advanced technology and streamlined processes. MediGuard is an immediate health shadowing and ambulance dispatch frame using wearable bias and sophisticated information analytics. It providesvisionary health shadowing for individualities and nippy ambulance dispatch during extremities. The AARS enhances EMS effectiveness by exercising immediate information from GPS, medical detectors, and stoner input to describe extremities. Upon alert activation, the frame identifies the nearest available ambulance equipped withnecessary medical installations and optimally routes it to the extremity position. crucial features include live shadowing, communication between askers and medical professionals, and automated patient health shadowing during conveyance. Both fabrics use Wi-Fi and cellular networks for flawless information transmission, addressingcritical conditions to ameliorate EMS effectiveness and case care. The frame aims to significantly reduce responsetimes, save lives, and ameliorate overall medical services issues.

KEYWORDS

ESP8266, Firebase, Firebase Cloud Messaging(FCM), Database

I.INTRODUCTION

A. MEDIGUARD

MediGuard represents a transformative vault in medical services technology, offering a comprehensive wearable health shadowing frame with automatic ambulance alert capabilities. Seamlessly blendingslice-edge detectors and sophisticated algorithms, MediGuard provides druggies with nonstop perceptivity into theirvital signs, including heart rate, SpO2 situations, body temperature, and precise GPS position. The frame's visionaryapproach to health operation shines in extremity situations. When abnormal health parameters are detected or wear and tear activate the extremity button, MediGuard springs into action. using its intelligent alert frame and Firebase pall integration, it incontinently notifies extremity askers, easing nippy ambulance dispatch to the wear and tear's exact position. This rapid-fire response medium is inestimable in critical moments, potentially saving lives and minimizing medical complications. Beyond extremity scripts, MediGuard fosters a sense of security and peace of mind for druggies and their families. Its stoner-friendly interface and dependable performance empower individualsto lead active lives while knowing that help is readily available when demanded. By incorporating advanced technology with compassionate care, Mediguard sets a new standard in individualized medical services, ensuring that every individual receives the attention and support they earn, precisely when they need it most.

B. EXISTING SYSTEM

Being work in wearable bias formerly offered expansive health shadowing capabilities, includingheart rate, physical exertion shadowing, and sleep analysis. Similarly, pall-grounded platforms are generally used forstoring and assaying information collected by wearable bias, enabling remote shadowing and flawless integration with extremity response protocols.

C. PROPOSED SYSTEM

By erecting these technologies and incorporating innovative features," MediGuard" aims to give a comprehensive result for immediate health shadowing and rapid-fire extremity backing, eventually enhancing the safety and well-being of druggies. The proposed frame operates under the control of an ESP-32 microcontroller, serving as the central processing unit. Detector modules including the MAX30105 for heart rate and SpO2 shadowing, and the LM35 for body temperature seeing, are integrated into the frame. These detectors continuously collect physiological information.Upon surpassing predefined threshold values, the ESP- 32 triggers cautions. Data packets containing the wear and tear's position, along with the alert status, are transmitted to the Firebase Cloud via the ESP-32's communication capabilities. likewise, a devoted drive button is incorporated into the frame, allowing the wear and tear to manually initiate extremity cautions. When pressed, the drive button triggers the ESP- 32 to shoot immediate position and extremity status updates to the Firebase Cloud.This comprehensive frame provides immediate health shadowing and enables prompt extremityresponse, enhancing wear and tear safety and easing timely backing when demanded.

D. BLOCK DIAGRAM

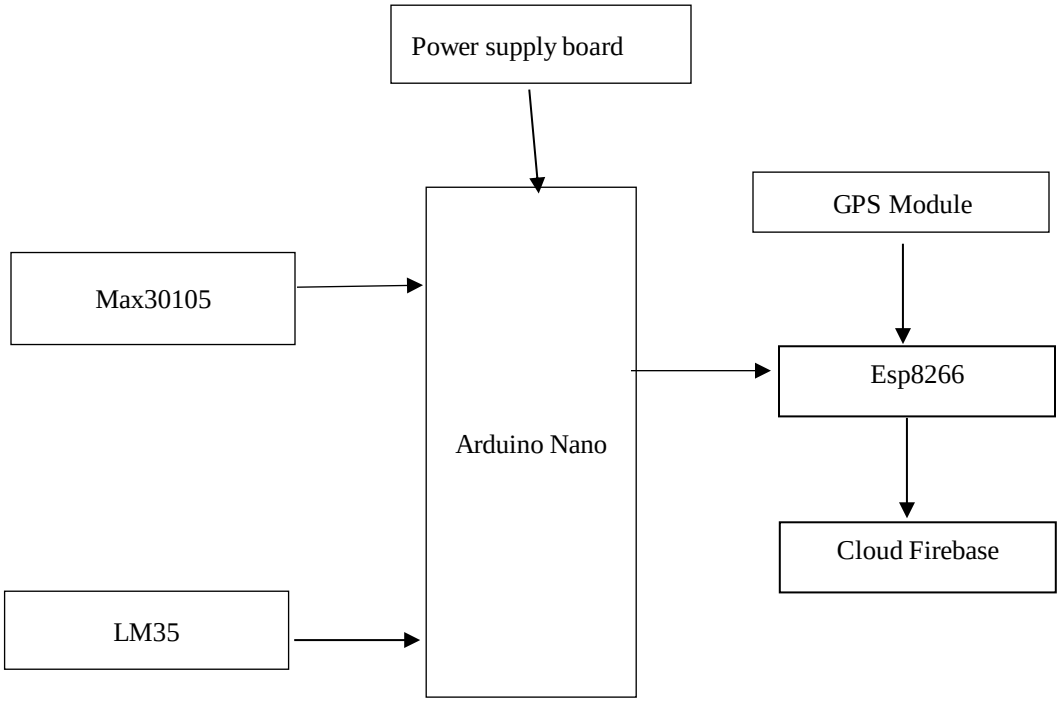

Fig.1 Block Diagram

E. INTRODUCTION TO IOT

IoT refers to an Internet of effects (IoT). Connecting any device (including everything from cell phones, vehicles, home appliances, and other wearable bedded with detectors and selectors) with the Internet so thatthese objects can change information with each other on a network. It's intriguing to note that there's a difference between IoT and the Internet; it's the absence of a mortal part. The IoT bias can produce information about existent'sactions, dissect it, and take action. Smart Systems and the Internet of the effects are driven by a combination of:

- Detectors & Selectors
- Connectivity
- People & Process

F. INTEROPERABILITY IN IOT

The Internet of Effects (IoT) is an incredibly different space, encompassing a large variety of tackleform factors and software eco-frameworks, unlike anything we've seen in technology. Smartwatches, connected cameras, drones, thermostats, voice-enabled speakers, smart appliances and further they all live together within theIoT. The diversity and invention that excites numerous IoT suckers is a big challenge not just for manufacturers andinventors, but also (and most importantly) consumers.

Which technology options should be used when designing orplanting IoT bias? How do they keep up with streamlined or new operating fabrics? What about new software and connectivity technologies coming up? Those are just some of the moment's challenges.

Having a single, unified communication and software frame for the IoT seems like an ideal result, but the different and fast-paced nature ofthe IoT makes this Cockaigne a big challenge. Diversity in the IoT is n't a commodity to be answered, but an aspectthat must be embraced and managed.

G. APPLICATION AREAS FOR THE INTERNET OF THINGS

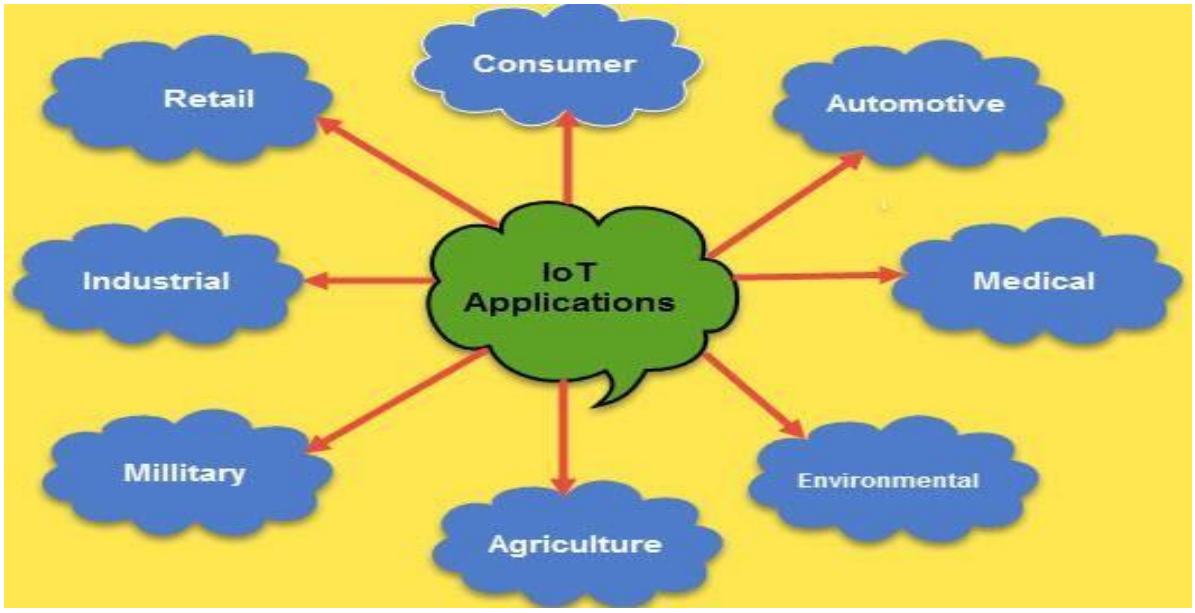

Fig.2 Application of IOT

a. SMART HOME

The concept of a Smart Home is brought up to save time, energy, and plutocrats. With the prefaceof Smart Homes, we would be able to switch on air exertion before reaching home switch off lights indeed after leaving home or unlock the doors to musketeers for temporary access when you aren't at home.

b. SMART CITIES

Smart surveillance, automated transportation, smarter energy operation fabrics, water distribution,civic security, and environmental tracking all are exemplifications of Internet of Effects operations for smart metropolises. IoT will break major problems faced by the people living in metropolises like pollution, business traffic, and deficit of energy inventories, etc. By installing detectors and using web operations, citizens can find free available parking places across the megacity. Also, the detectors can describe cadence tampering issues, general malfunctions, and any installation issues in the electricity frame.

c. WEARABLES

Wearable biases are installed with detectors and software which collect information and informationabout the druggies. This information is latterly pre-processed to prize essential perceptivity about stoner. These biases astronomically cover fitness, health, and entertainment conditions. The prerequisite from internet of effectstechnology for wearable operations is to be largely energy-effective or ultra-low power and small-sized.

d. HEALTHCARE

IoT in medical services is aimed at empowering people to live healthier lives and regular scans by wearing connected bias. The collected information will help in the substantiated analysis of an existent’s health and give knitter-made strategies to combat illness.

H. SECURITY CHALLENGES

Security is a big issue with IoT bias. With billions of biases being connected together over the Internet, how can people be sure that their information is secure? These security issues can be of the following kinds.

a.DATA ENCRYPTION

IoT operations collect tons of information. Data reclamation and processing is an integral part ofthe whole IoT terrain. utmost of this information is particular and needs to be defended through encryption. Encryption is extensively used on the internet to cover stoner information being transferred between a cybersurfed and a garçon, including watchwords, payment information and other particular information that should be considered private.

b. DATA AUTHENTICATION

After successful encryption of information chances of the device itself being addressed still exist.However, security is compromised, if there's no way to establish the authenticity of the information being communicated to and from an IoT device. For case, say you erected a temperature detector for smart homes. Indeed, though you cipher the information it transfers there's no way to authenticate the source of information also anyone can make up fake information and shoot it to your detector instructing it to cool the room when it is freezingor vice versa.

c. SIDE-CHANNEL ATTACKS

Encryption and authentication both in place still leave a compass for side-channel attacks. similar attacks concentrate less on the information and further on how that information is being presented.

d. DATA AUTHENTICATION

After successful encryption of information chances of the device itself being addressed still exist.However, security is compromised, if there's no way to establish the authenticity of the information being communicated to and from an IoT device. For case, say you erected a temperature detector for smart homes. Indeed, though you cipher the information it transfers there's no way to authenticate the source of information also anyone can make up fake information and shoot it to your detector instructing it to cool the room when it is freezingor vice versa.

e. SIDE-CHANNEL ATTACKS

Encryption and authentication both in place still leave a compass for side-channel attacks. similar attacks concentrate less on the information and further on how that information is being presented.

f. PRIVACY CHALLENGES

Also, we have the issue of sequestration and information sharing. That's because these biases not only collect particular information like druggies' names and telephone figures but can also cover stoner conditioning (e.g., when druggies are in their houses and what they had for lunch).

g. CONNECTIVITY CHALLENGES—BILLIONS OF DEVICES ON A CENTRALIZED SERVER

One of the biggest challenges for IoT in the future is to connect a large number of biases and massive quantities of information that all of these biases are going to produce. There will be a need to find a way to store,track, dissect, and make sense of the vast quantities of information that will be generated. Presently, we calculateupon a centralized, garçon/ customer model to authorize, authenticate, and connect several bumps present on the network. This model is sufficient

for the number of IoT biases that are presently a part of the eco framework.

h.COMPATIBILITY AND LONGEVITY CHALLENGES-EXTRA HARDWARE AND SOFTWARE

Different technologies like ZigBee, Z-Wave, Wi-Fi, Bluetooth, and Bluetooth Low Energy (BTLE) areall battling to become the dominant transport medium between bias and capital. This becomes a major source of problems when a lot of bias has to be connected; similar thick connectivity requires the deployment of redundanttackle and software. exchanges about the IoT are taking place all over the world as we're trying to understand howthis will impact our lives. We're also trying to understand what the numerous openings and challenges are going to be as further and further bias starts to join the IoT. So, all that we can do is educate ourselves about what the IoT is and how it'll be after some time.

I. FIREBASE

With a variety of garçon-side technologies that are on the request moment, inventors have a tough job deciding what kind of backend is most suitable for their app. In this post, we will explore one of these choices that go by the name of Firebase, and all the tools and services that it provides. Firebase is a mobile and web app development platform that provides inventors with a plethora of tools and services to help them develop high- quality apps, grow their stoner base, and earn further profit. Back in 2011, before Firebase was Firebase, it was a launch-up called Envolve. As Envolve, it handed inventors an API that enabled the integration of online conversefunctionality into their website.

What's intriguing is that people used Envolve to pass operation information that was further than just converse dispatches. inventors were using Envolve to sync operation information similar as a game state in real-time across their druggies. This led the authors of Envolve, James Tamplin and Andrew Lee,to separate the converse frame and the immediate armature. In April 2012, Firebase was created as a separate company that provided Backend service with immediate functionality. After it was acquired by Google in 2014, Firebase fleetly evolved into the multifunctional mammoth of a mobile and web platform that it is moment.

a. REAL-TIME DATABASE

The Firebase Real-time Database is a pall-hosted NoSQL information base that lets you store and syncbetween your druggies in Real-time. The Real-time Database is really just one big JSON object that the inventorscan manage in real-time.

Real-time Database = > A Tree of Values

With just a single API, the Firebase information base provides your app with both the current value of the information and any updates to that information. Real-time syncing makes it easy for your druggies to pierce their information from any device, be it web or mobile. Real-time Database also helps your druggies unite with one another. Another amazing benefit of Real-time Database is that it vessels with mobile and web SDKs, allowingyou to make your apps without the need for waiters. When your druggies go offline, the Real-time Database SDKsuse the original cache on

the device to serve and store changes. When the device comes online, the original information is automatically accompanied. The Real-time Database can also integrate with Firebase Authentication to give a simple and intuitive authentication process.

b. AUTHENTICATION

Firebase Authentication provides backend services, easy-to-use SDKs, and ready-made UI libraries to authenticate druggies to your app. Typically, it would take you months to set up your own authentication frame. And indeed, after that, you would need to keep a devoted platoon to maintain that frame. But if you use Firebase,you can set up the entire frame in under 10 lines of law that will handle everything for you, including complex operations like account coupling.

We can authenticate our app's druggies through the following styles

- Dispatch & word
- Phone figures
- Google
- Facebook
- Twitter
- & more!

Using Firebase Authentication makes structure secure authentication fabrics easier, while also perfectingthe sign-in and onboarding experience for end druggies. Firebase Authentication is erected by the same people who created Google Subscribe-, Smart Lock, and Chrome Word Director.

c. FIREBASE CLOUD MESSAGING (FCM)

Firebase pall Messaging (FCM) provides a dependable and battery-effective connection between your garçon and bias that allows you to deliver and admit dispatches and announcements on iOS, Android, and the webat no cost. You can shoot announcement dispatches (2KB limit) and information dispatches (4KB limit). Using FCM, you can fluently target dispatches using predefined parts or produce your own, using demographics and gets. You can shoot dispatches to a group of biases that are subscribed to specific motifs, or you can get as grainyas a single device. FCM can deliver dispatches incontinently, or at an unborn time in the stoner's original time zone. You can shoot custom app information like setting precedence's, sounds, and expiration dates, and also trackcustom conversion events. The stylish thing about FCM is that there's hardly any coding involved! FCM is fully integrated with Firebase Analytics, giving you detailed engagement and conversion shadowing.

d. FIREBASE DATABASE QUERY

Firebase has simplified the process of reacquiring specific information from the information base throughqueries. Queries are created by chaining together one or more sludge styles.
Firebase has 4 ordering functions

- Order By Key ()
- Order By Child ('child')
- Order By Value ()
- Order By Priority ()

II REVIEW OF LITERATURE

A. REVIEW OF LITERATURE

Literature check is a frame tic and thorough hunt of all types of published literature as well as other sources including discussion, these to identify as numerous particulars as possible that are applicable to a particularcontent.

a. Title: " Intelligent Ambulance Dispatch Systems A Comprehensive Survey"

Author: Sophia Patel

Time: 2023

Overview: This review focuses on recent advancements in intelligent ambulance dispatch fabrics, including the integration of immediate information analytics, machine literacy algorithms, and crowd-sourced information. It explores how these technologies enhance extremity response by perfecting dispatch delicacy, optimizing routing, and easing dynamic resource allocation.

Advantage: Enhanced responsiveness, bettered decision- timber, and better adaption to dynamic extremity situations.

Disadvantage: Reliance on accurate and over-to-date information sources, implicit impulses in algorithmic decision-timber, and challenges in integrating miscellaneous information sources.

b. Title: "Next-Generation Automatic Ambulance Routing System A Comprehensive Survey"

Author: Daniel Wong

Time: 2022

Overview: This check examines recent trends and inventions in automatic ambulance routing fabrics, including theuse of artificial intelligence, prophetic analytics, and multi-criteria optimization ways. It discusses how these advancements enable more effective routing, brisk response times, and enhanced patient issues in extremity medical services.

Advantage: Enhanced routing delicacy, adaptive response to changing business conditions, and ameliorated scalability for large-scale extremity events.

Disadvantages: Complexity in algorithm design, implicit computational outflow, and the need for nonstop confirmation and refinement.

c. Title: " Advancements in Autonomous Ambulance Systems A Comprehensive Survey"

Author: Rachel Johnson

Time: 2024

Overview: This review examines recent developments in independent ambulance fabrics, including advancements in tone- driving vehicle technology, detector emulsion, and artificial intelligence. It explores how these inventions are transubstantiating extremity medical services by enabling independent navigation, remote shadowing, and telemedicine capabilities onboard ambulances.

Advantage: Reduced response times, bettered safety through independent driving, and enhanced medical care delivery during conveyance.

Disadvantages: Regulatory challenges, public perception walls, and specialized limitations in independent vehicle deployment.

d. Title:" Recent Progress in Real- Time Ambulance Tracking Systems A Comprehensive Survey"

Author: Alexander Garcia

Time: 2023

Overview: This comprehensive check provides an overview of recent progress in immediate ambulance tracking fabrics, fastening on advancements in GPS technology, information visualization, and integration with extremity dispatch platforms. It discusses how these fabrics ameliorate situational mindfulness, collaboration among extremity askers, and patient care delivery.

Advantage: Enhanced visibility into ambulance locales, bettered response collaboration, and better communication among extremity services.

Disadvantages: sequestration enterprises regarding position information, implicit vulnerabilities to cyberattacks, and the need for robust information security measures.

e. Title:" Recent Advances in Optimization ways for Ambulance Routing A Comprehensive Survey"

Author: Julia Martinez

Time: 2022

Overview: This state-of-the-art review explores recent advances in optimization ways for ambulance routing, including metaheuristic algorithms, cold-blooded approaches, and immediate adaptive strategies. It highlights how these advancements address the complexity of extremity medical service logistics, leading to more effective resource allocation and brisk extremity response times.

Advantages: bettered route optimization, adaptive response to dynamic conditions, and scalability for large-scale extremity events.

Disadvantages: Computational complexity, perceptivity to parameter settings, and challenges in immediate perpetration on resource-constrained platforms.

III.IMPLEMENTATION

A. FIRE BASE

Firebase is a mobile and web app development platform that provides inventors with a plethora of tools and services to help them develop high-quality apps, grow their stoner base, and earn further profit.

a. Brief History

Back in 2011, before Firebase was Firebase, it was a launch-up called Envolve. As Envolve, it handedinventors an API that enabled the integration of online converse functionality into their website. What's intriguing is that people used Envolve to pass operation information that was further than just converse dispatches. inventors were using Envolve to sync operation information similar to a game state in real-time across their druggies.

This led the authors of Envolve, and, to separate the converse frame and the immediate armature. In April 2012, Firebase was created as a separate company that provided Backend service with immediate functionality.After it was acquired by Google in 2014, Firebase fleetly evolved into the multifunctional mammoth of a mobile and web platform that it is moment.

b. Real-time Database

The Firebase Real-time Database is a pall-hosted NoSQL information base that lets you store and syncbetween your druggies in Real-time. The Real-time Database is really just one big JSON object that the inventors can manage in real time.

Real-time Database = > A Tree of Values

With just a single API, the Firebase information base provides your app with both the current value ofthe information and any updates to that information.

Limit To First (10)

Limit To Last (10) Real-time syncing makes it easy for your druggies to pierce their information fromany device, be it web or mobile. Real-time Database also helps your druggies unite with one another. Another amazing benefit of Real-time Database is that it vessels with mobile and web SDKs, allowing you to make your apps without the need for waiters.

B. FIREBASE CLOUD MESSAGING (FCM)

Firebase pall Messaging (FCM) provides a dependable and battery-effective connection between your garçon and bias that allows you to deliver and admit dispatches and announcements on iOS, Android, and the web at no cost. We can shoot announcement dispatches (2KB limit) and information dispatches (4KB limit). Using FCM, you can fluently target dispatches using predefined parts or produce your own, using demographics and gets. You can shoot dispatches to a group of biases that are subscribed to specific motifs, or you can get as grainy as a single device. FCM can deliver dispatches incontinently, or at an unborn time in the stoner's original time zone. You can shoot custom app information like setting precedence's, sounds, and expiration dates, and also track custom conversion events. The stylish thing about FCM is that there's hardly any coding involved! FCM is fully integrated with Firebase Analytics, giving you detailed engagement and conversion shadowing.

C. FIREBASE DATABASE QUERY

Firebase has simplified the process of reacquiring specific information from the information base through queries. Queries are created by chaining together one or more sludge styles.

Firebase has 4 ordering functions

- Order By Key ()
- Order By Child ('child')
- Order By Value ()
- Order By Priority ()

Note that we will only admit information from a query if you have used the on() or formerly() system.We can also use these advanced querying functions to further circumscribe information

- Start At ('value')
- End At ('value')
- Equal To ('child key')
- Limit To First (10)
- Limit To Last (10)

In SQL, the basics of querying involve two ways. First, you elect the columns from your table. Then I'm opting for the druggie's column. Next, you can apply a restriction to your query using the WHERE clause. From the below-given query, I'll get a list of druggies whose name is Geek Ants.We can also use the LIMIT clause, which will circumscribe the number of results that you'll get backfrom your query.

In Firebase, querying also involves two ways. First, you produce a reference to the parent key and alsoyou use an ordering function. Voluntarily, you can also tack a querying function for a more advanced confining.

Fig .3 Firebase Query

```
const db = firebase.database();

const firebaseRef = db.child(`child`);

firebaseRef.orderByChild("user").equalTo("GeekyAnts").on("child_added",
    function(snapshot) {
        console.log(snapshot.key);
    }
);
```

Fig.4 Firebase QuerY

How to Store Data? => Firebase Storage

Firebase storehouse is a standalone result for uploading stoner- generated content like images and vids from an iOS and Android device, as well as the Web. Firebase Storage is designed specifically to gauge your apps, give security, and insure network resiliency. Firebase Storage uses a simple brochure/ train frame to structure its information.

Fig.5 Firebase Query

D. QUERY WITH FIRE STORE

Imagine that you have created a collection in Fire store that contains a list of metropolises. So, beforeyou can shoot out query, you'll have to store the information base inside a variable

Fig.6 Firestore query

Then's another illustration of queries in Fire store. Say you want to see only 2 of metropolises fromyour information base whose population is further than 100,000.

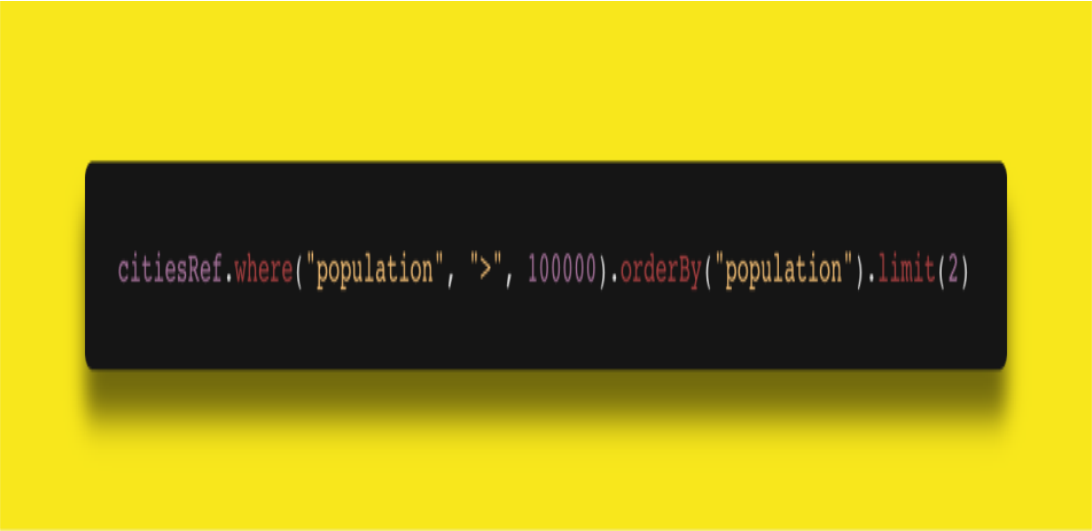

Fig.7 Firestore query

But Cloud Firestore can make querying indeed easier! In some cases, Cloud Fire store can automatically search your information base across multiple fields. Fire store will guide you towards automaticallyerecting an indicator that will help Firestore to make querying extremely simple.

Fig.8 Firestore IndeX

E. BETTER SCALABILITY

Though Firebase's Real-time Database is capable of scaling, effects will start to get crazy when your app becomes really popular or if your information base becomes really massive. Cloud Fire store is grounded on Google's Cloud structure. This allows it to gauge much more fluently and to a lesser capacity than the Realtime Database.

F. PSYCHOLOGICAL DATA

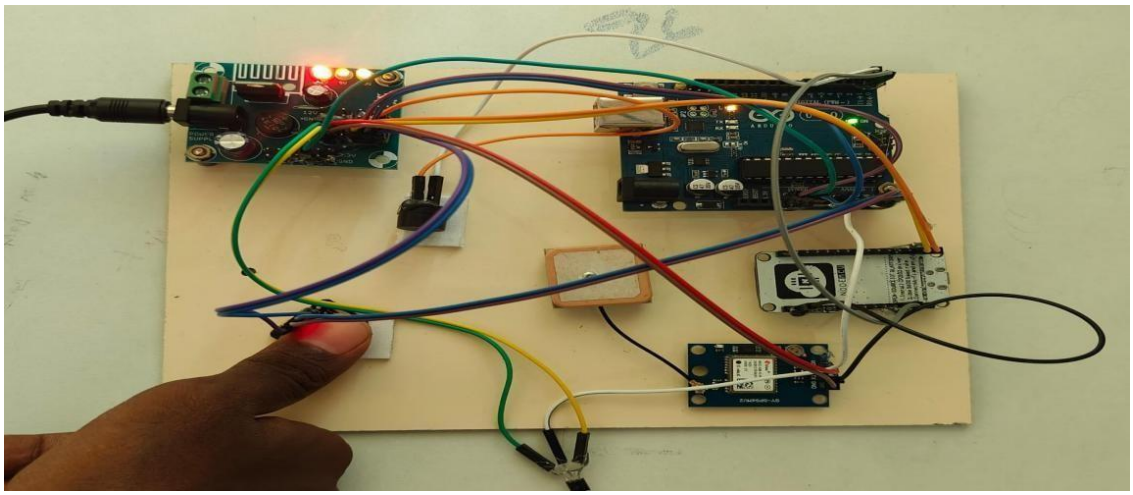

Fig.9 Psychological Data

G. FIREBASE RESULT

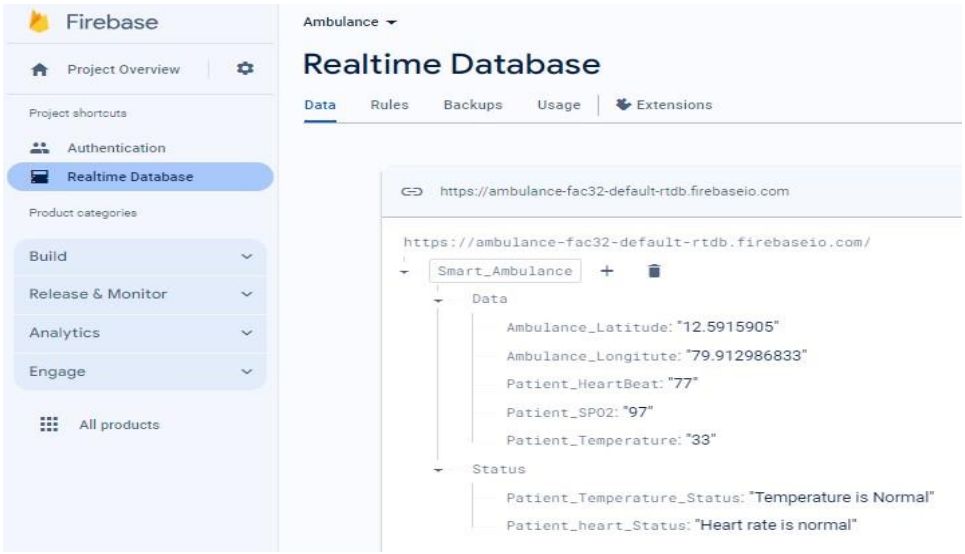

Fig.10 Firebase Result

IV. CONCLUSION

The proposed health monitoring system represents a slice- edge technological result that harnesses the computational power of the ESP- 32 microcontroller to deliver comprehensive and real- time physiological shadowing. At its core, the system integrates multiple sophisticated sensor modules, including the MAX30105 photoplethysmography(PPG) detector for precise heart rate and oxygen achromatism monitoring, and the LM35 temperature detector for accurate body temperature dimension. These precisely named factors work synergistically to produce a robust health surveillance platform able of nonstop and multifaceted physiological data collection. The system's advanced algorithmic frame enables real- time analysis of vital signs, with intelligent threshold- grounded discovery mechanisms that can incontinently fete and flag implicit health anomalies.

When predefined physiological parameters are traduced, the system triggers immediate alert protocols, generating comprehensive data packets that synopsize detailed health criteria , device status, and critical warning information. The flawless integration with Firebase pall structure ensures immediate data transmission, furnishing healthcare providers and druggies with remote, real- time access to critical health information. This pall- grounded approach not only facilitates immediate intervention in implicit medical extremities but also supports long- term health trend analysis, transubstantiating the paradigm of particular health monitoring through sophisticated technological integration and intelligent data operation.

V. FUTURE WORK

The future Compass design represents a transformative approach to healthcare technology, with profound eventuality for unborn development and invention. By strategically expanding the integration of wearable biosensors and Internet of effects(IoT) sensors, the system aims to revise healthcare delivery through nonstop, individualized health monitoring. unborn duplications will concentrate on advancing the technological ecosystem to enable more sophisticated, real- time physiological shadowing that goes beyond current limitations. This will involve developing further advanced detector technologies able of landing decreasingly nuanced health criteria , including advanced biomarkers, molecular- position physiological changes, and prophetic health pointers.

The computational structure will be enhanced to influence artificial intelligence and machine literacy algorithms, enabling further intelligent pattern recognition, early complaint discovery, and substantiated health vaticination models. Critically, the design will prioritize robust information security fabrics, enforcing slice- edge encryption protocols and comprehensive data sequestration measures to insure absolute protection of sensitive particular health information. This approach wo n't only meet strict nonsupervisory compliance norms but also make stoner confidence by demonstrating an unvarying commitment to data protection and individual sequestration. also, the system will explore interdisciplinary collaborations, integrating perceptivity from medical exploration, data wisdom, and advanced electronics to produce a holistic, adaptive health monitoring platform that can stoutly respond to individual health requirements and arising medical technologies.

VI. REFERENCE

[1] Yang, B.; Haghighat, F.; Fung, B.C.; Panchabikesan, K. Season-Based Occupancy Prediction in Residential Buildings Using Machine Learning Models. E-Prime-Adv. Electr. Eng. Electron. Energy 2021, 1, 100003. [] []

[2] Naseem, S.; Alhudhaif, A.; Anwar, M.; Qureshi, K.N.; Jeon, G. Artificial general intelligence-based rational behavior detection using cognitive correlates for tracking online harms. Pers. Ubiquitous Comput. 2022, 17, 1–9. [] []

[3]Rajesh, G.; Benny, A.R.; Harikrishnan, A.; Abraham, J.J.; John, N.P. A Deep Learning based Accident Detection System. In Proceedings of the 2020 International Conference on Communication and Signal Processing (ICCSP), Chennai, India, 28–30 July 2020; pp. 1322–1325. []

[4] Wang, C.; Dai, Y.; Zhou, W.; Geng, Y. A Vision-Based Video Crash Detection Framework for Mixed Traffic Flow Environment Considering Low-Visibility Condition. J. Adv. Transp. 2020, 2020, 9194028. [] [] []

[5] Bhakat, A.; Chahar, N.; Vijayasherly, V. Vehicle Accident Detection & Alert System using IoT and Artificial Intelligence. In Proceedings of the 2021 Asian Conference on Innovation in Technology (ASIANCON), Pune, India, 27–29 August 2021; pp. 1–7. []

[6] Choi, J.G.; Kong, C.W.; Kim, G.; Lim, S. Car crash detection using ensemble deep learning and multimodal information from dashboard cameras. Expert Syst. Appl. 2021, 183, 115400. [] []

[7] Pour, H.H.; Li, F.; Wegmeth, L.; Trense, C.; Doniec, R.; Grzegorzek, M.; Wismüller, R. A Machine Learning Framework for Automated Accident Detection Based on Multimodal Sensors. Cars. Sens. 2022, 2022, 1–21. []

[8] Comi, A.; Polimeni, A.; Balsamo, C. Road Accident Analysis with Data Mining Approach: Evidence from Rome. Transp. Res. Procedia 2022, 62, 798–805. [] []

[9] Park, E.S.; Fitzpatrick, K.; Das, S.; Avelar, R. Exploration of the relationship among roadway characteristics, operating speed, and crashes for city streets using path analysis. Accid. Anal. Prev. 2021, 150, 105896. [] [] []

[10] Singh, G.; Pal, M.; Yadav, Y.; Singla, T. Deep neural network-based predictive modeling of road accidents. Neural Comput. Appl. 2020, 32, 12417–12426. [] []

[11] Gupta, R.K.; Bharti, S.; Kunhare, N.; Sahu, Y.; Pathik, N. Brain Tumor Detection and Classification Using Cycle Generative Adversarial Networks. Interdiscip. Sci. Comput. Life Sci. 2022, 17, 1–17. []

[12] Xie, Y.; Xie, B.; Wang, Z.; Gupta, R.K.; Baz, M.; AlZain, M.A.; Masud, M. Geological Resource Planning and Environmental Impact Assessments Based on GIS. Sustainability 2022, 14, 906. [] []

[13] Yan, L.; Cengiz, K.; Sharma, A. An improved image processing algorithm for automatic defect inspection in TFT-LCD TCON. Nonlinear Eng. 2021, 10, 293– 303. [] []

[14] Zhang, X.; Rane, K.P.; Kakaravada, I.; Shabaz, M. Research on vibration tracking and fault diagnosis of rotating machinery based on internet of things technology. Nonlinear Eng. 2021, 10, 245–254. [] []

[15] Guo, Z.; Xiao, Z. Research on online calibration of lidar and camera for intelligent connected vehicles based on depth-edge matching. Nonlinear Eng. 2021, 10, 469–476. [] []

[16] Xie, H.; Wang, Y.; Gao, Z.; Ganthia, B.P.; Truong, C.V. Research on frequency parameter detection of frequency shifted track circuit based on nonlinear algorithm. Nonlinear Eng. 2021, 10, 592–599. [] []

[17] Liu, J.; Khattak, A.J.; Li, X.; Nie, Q.; Ling, Z. Bicyclist injury severity in traffic crashes: A spatial approach for geo-referenced crash information to uncover non- stationary correlates. J. Saf. Res. 2020, 73, 25–35. [] [].

[18] Dashora, C.; Sudhagar, P.E.; Marietta, J. IoT based framework for the detection of vehicle accident. Cloud Comput. 2019, 2, 1–16. [] []

[19] Yan, L.; Cengiz, K.; Sharma, A. An improved image processing algorithm for automatic defect inspection in TFT-LCD TCON. Nonlinear Eng. 2021, 10, 293– 303. [] []

[20] Zhang, X.; Rane, K.P.; Kakaravada, I.; Shabaz, M. Research on vibration tracking and fault diagnosis of rotating machinery based on internet of things technology. Nonlinear Eng. 2021, 10, 245–254. [] []