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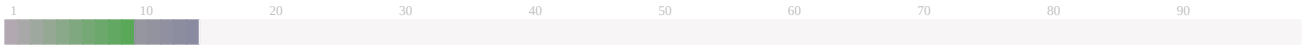

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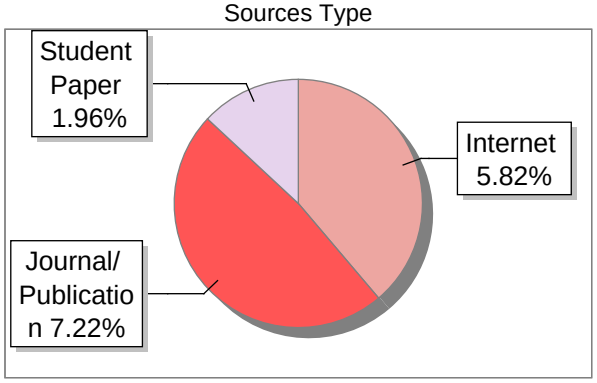

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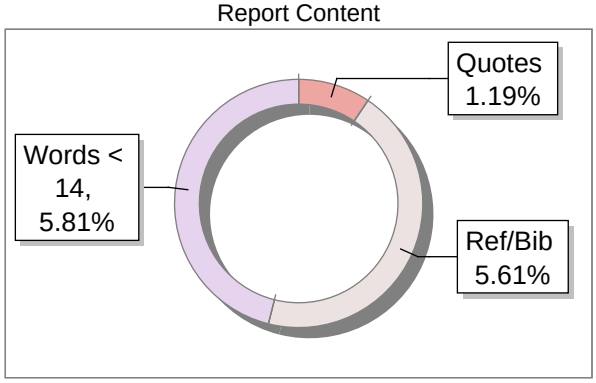

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VISVESVARAYA TECHNOLOGICAL UNIVERSITY
BELAGAVI-590018

Project (20CIPP83)

Report on

"SMARTWATCH-BASED HEART ATTACK DETECTION AND HEALTH MONITORING SYSTEM"

Submitted in the partial fulfillment of the requirement for the Project

Bachelor of Engineering

In

CSE(AI&ML)

Submitted by

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Mr. Rajan Kumar R	1NC20CI031
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2023-2024

NAGARJUNA
COLLEGE OF ENGINEERING & TECHNOLOGY

DEPARTMENT OF CSE (Artificial Intelligence &Machine Learning)

CERTIFICATE

This is to Certify that the project **"SMARTWATCH-BASED HEART ATTACK DETECTION AND HEALTH MONITORING SYSTEM"** carried out by Mr. Abhishek KN(1NC20CI001), Mr. Rajan Kumar R (1NC20CI031), and Ms. Swathi G(1NC20CI040), Bonafide students of Nagarjuna College of Engineering and Technology, Bangalore an autonomous college under Visvesvaraya Technological University, Belagavi, in partial fulfillment for the project work carried out by them for the course Project during the year 2023-2024.

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ABSTRACT

The Smartwatch-Based Heart Attack Detection and Health Monitoring System is an innovative technology designed to empower individuals with real-time monitoring of their heart health using a smartwatch. This system primarily focuses on continuously tracking heart rate and blood pressure, crucial indicators of cardiovascular health. The smartwatch is equipped with advanced sensors that detect any significant deviations from normal heart rate patterns, which might indicate potential heart issues. Upon identifying abnormal changes, the system immediately alerts emergency contacts, providing an opportunity for quick medical intervention. This real-time monitoring and instant alert capability are vital for early detection and response, potentially saving lives by ensuring timely medical assistance. In addition to its real-time alert system, the smartwatch incorporates GPS technology to enhance the emergency response process. During a critical cardiac event, not only does the system notify emergency contacts, but it also transmits the user's precise location. This feature ensures that emergency services can quickly locate and assist the user, significantly improving the chances of survival and recovery in severe cardiac events. The integration of location data with health alerts creates a comprehensive emergency response mechanism that is both efficient and effective, bridging the gap between incident detection and medical intervention. Beyond emergency response, the system functions as a robust health data repository. It continuously stores historical data on heart rate, blood pressure, and other relevant health metrics, providing a valuable resource for both users and healthcare professionals. This data allows users to track their health progress over time, identify trends, and make informed lifestyle adjustments. For healthcare providers, access to this detailed health history enhances diagnostic accuracy and informs treatment planning, leading to better patient outcomes. By combining real-time monitoring, precise emergency alerting, and comprehensive health data logging, the Smartwatch-Based Heart Attack Detection and Health Monitoring System offers a holistic approach to managing cardiovascular health, promoting both preventive care and effective emergency response.

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CHAPTER-1

SMARTWATCH-BASED HEART ATTACK DETECTION AND HEALTH MONITORING SYSTEM

1.1 INTRODUCTION

In recent years, the integration of technology into daily life has brought about transformative changes, especially in the domain of personal health management. Among the myriad of technological advancements, smartwatches have emerged as vital tools, offering a holistic approach to health and well-being. With the capacity to monitor various health parameters continuously, smartwatches have revolutionized how individuals track and manage their health. The fusion of wearable technology with health monitoring capabilities has created new opportunities for proactive health management, enhancing the ability to detect and respond to health issues promptly. Our project, the "Smartwatch-Based Heart Attack Detection and Health Monitoring System with Integrated GPS and Notification App," epitomizes this technological revolution, aiming to empower individuals to take control of their cardiovascular health.

The "Smartwatch-Based Heart Attack Detection and Health Monitoring System" leverages the ubiquity of smartwatches and advances in health monitoring technologies to provide users with a comprehensive health management tool. By integrating heart attack detection, GPS tracking, and real-time notifications, our project stands at the forefront of personal health technology. The continuous advancements in wearable technology and health sensors have laid a fertile ground for developing innovative solutions that significantly enhance the quality of life. As smartwatches become more common and their capabilities expand, the potential to positively impact health management practices grows, making them indispensable in daily health monitoring and emergency response.

One of the standout features of our system is its real-time heart attack detection capability, which sets it apart from traditional health monitoring devices. Utilizing advanced sensors and algorithms, the smartwatch can detect significant deviations in heart rate and other critical indicators that may signify a heart attack. This real-time detection ensures that users receive timely alerts, enabling swift intervention during critical cardiac events. The ability to promptly alert users to potential heart issues is a game-changer in health monitoring, providing a proactive approach to managing cardiovascular health and significantly improving the chances of positive outcomes in emergency situations. The inclusion of GPS tracking in our smartwatch system further enhances its functionality, providing an added layer of safety and utility. GPS technology allows the smartwatch to track the user's location, offering valuable data on physical activity and ensuring that users are safe, particularly in emergency scenarios. During a cardiac event, the GPS feature becomes invaluable, as it enables the system to share the user's precise location with emergency contacts and medical responders. This integration of health monitoring and location tracking transforms the smartwatch into a critical tool for personal safety and emergency response, bridging the gap between detection and timely medical intervention.

1.2 OBJECTIVE

1. Develop an Alert System for Instant Notification to Users and Emergency Contacts

The primary objective of our project is to design a reliable and efficient alert mechanism within the smartwatch that can promptly notify users and their designated emergency contacts in case of abnormal health readings or potential heart attack detection. This involves utilizing advanced sensors that continuously monitor health metrics such as heart rate and blood pressure, coupled with sophisticated algorithms that can detect significant deviations from normal values. Upon detecting a potential issue, the system will send immediate alerts through various communication channels including SMS, email, and in-app notifications. This real-time alert system is crucial for enabling swift intervention during critical health events, potentially saving lives by ensuring timely medical assistance. The alert mechanism will be customizable, allowing users to define who gets notified and under what specific health circumstances, thus providing a personalized and responsive health monitoring experience.

2. Provide Resources Within the Smartwatch Interface to Educate Users About Their Health Data

Another key objective is to create an informative and user-friendly interface on the smartwatch that educates users about their health metrics and trends. This involves integrating educational resources directly into the smartwatch, such as health tips, explanations of monitored metrics (e.g., what constitutes a normal heart rate or blood pressure), and guidance on how to interpret these readings. Visual aids such as graphs and charts will be included to help users understand their health data over time. By providing these resources, the smartwatch will not only serve as a monitoring device but also as an educational tool that empowers users to better understand and manage their health.

3. Integrate Communication Features for Interaction with Emergency Services During Critical Events

To enhance the utility of the smartwatch in emergency situations, our system will integrate communication features that enable direct interaction with emergency services. This includes functionalities such as one-touch SOS calls, automated sharing of the user's location via GPS, and pre-recorded emergency messages that provide essential health information to responders. These features are designed to facilitate swift and effective medical intervention during critical health events. By ensuring that emergency services receive

precise and timely information, the smartwatch can significantly improve the chances of positive outcomes in emergency scenarios.

4. Allow Users to Set and Track Personalized Health Goals

Empowering users to take proactive control of their health is a fundamental objective of our project. The smartwatch will offer features that allow users to set and track personalized health goals related to various health metrics, such as daily step count, optimal heart rate range, and blood pressure targets. The system will provide regular feedback and progress reports, helping users stay motivated and informed about their health progress. This goal-setting functionality is aimed at encouraging users to adopt healthier habits and routines, thereby promoting long-term well-being.

5. Encourage Proactive Health Management and Lifestyle Choices

The smartwatch is designed to promote a proactive approach to health management by encouraging users to make informed lifestyle choices. Features such as activity reminders, dietary suggestions, and wellness challenges will be integrated into the system to motivate users to engage in healthier behaviors. The smartwatch will provide insights and recommendations based on the user's health data, helping them understand the impact of their lifestyle choices on their overall health. By fostering a proactive attitude towards health management, the smartwatch aims to improve users' long-term health outcomes.

6. Ensure Interoperability with Existing Healthcare Infrastructure and Electronic Health Records

To maximize the utility of the smartwatch, our project will ensure interoperability with existing healthcare infrastructure and electronic health records (EHR). This involves adhering to standard healthcare communication protocols and data formats, such as HL7 and FHIR, to facilitate seamless data exchange. The smartwatch will be capable of sharing health data with healthcare providers, allowing them to access and utilize this information in their clinical workflows. By integrating with EHR systems, the smartwatch can enhance the continuity of care and support more informed decision-making by healthcare professionals.

CHAPTER-2

2.1 LITERATURE SURVEY

SI. NO	TITLE, AUTHOR	ABSTRCT	METHODS/TECHNIQUES	CONCLUSION
[1]	SmartCare: using Detecting Heart Failure and Diabetes Smartwatch. (2022) IEEE Authors: Lahiru Colombage, Thisari Amarasiri, Tilshini Sanjeewani, ChiranthaSenevirathne, RrubaaPanchendrarajan	In this paper, the devices keep an eye on your health and can catch early signs of Heart Failure and Diabetes, even before you feel any symptoms. We use computer programs to predict these conditions. Tests with real patient information prove that our SmartCare system is good at finding and understanding heart problems and different types of diabetes.	Artificial Neural Network Deep convolutional Neural Network Several Machine Learning Arduino Sensors ECG	We've introduced a SmartCare solution That uses a smartwatch to detect heart failure, its severity, diabetes, and diabetes type. We collect three types of data—static, smartwatch, and on request—and send them to cloud services with machine learning models to predict users' health statuses in realtime. No specific lab tests are needed. Users can monitor their health statuses over time through a mobile and web app. Our models, based on local patient data, predict health statuses with an F1 score ranging from 0.7 to 0.86. Looking ahead, we plan to offer personalized recovery

				recommendations for heart failure and diabetes
[2]	The heart attack detection by Esp8266 data communicatio n at a real time to avoid sudden death. (2018) Conference Authors: Poltak Sihombing, Mangasa Manullang, Dahlan Sitompul, Imelda Sri Dumayanti	These days, heart attacks—which can occur when the heart's blood flow is interrupted—are killing a lot of people. This Internet-of Things (IoT)based innovation utilises heart rate monitoring to spot heart attacks (Internet of Things). This technology is highly effective in detecting heart attacks because it uses internet of things-based heart rate monitoring. An Arduino board, a pulse sensor, and a Wi-Fi module are all used in our method. When the gadget is setup, the pulse sensor will start measuring heart rates	SVM(support vector machine) CMAR(Classification based on multiple association rules) Fuzzy logic Pulse sensor Microcontroller Wi-fi modules (ESP8266) Arduino Uno	Based on the discussion and findings from the research, it was determined that the ESP8266 circuit successfully enabled data communication between the microcontroller and the smartphone. This allowed real-time transmission of heart rate data. The heart rate detector created can be used anywhere with WiFi connectivity. We used Pulse Sensors for heart rate detection, and they proved to be highly sensitive and effective when connected to a microcontroller.
[3]	IoT based Heart Attack Detection and Heart Rate Monitoring System. (2023) IEEE Authors: Dr. T. Arun Prasath M.Mohamed Arif S Srinivasan A Muthumanoj kumar M Sushmitha	IOT innovation effectively detects heart attack by utilizing heart rate monitoring. It enhances accuracy of detection. The continuously measures heart rate, providing a protective approach to identify potential heart attack and enabling timely intervention	C Programming language Android Smart Phone Arduino uno Pulse sensor ECG sensor GPS sensor WIFI Modul	Our system is flexible and can monitor various cardiovascular factors at the same time, such as heart rate, circulatory load, and patient temperature. The collected data is sent wirelessly using Bluetooth to an Android mobile device, which then transmits it to a

	Sakthivel Sankaran			web application for further monitoring and control. Through the web application, you can easily view details like the patient's age, gender, address, location, and current clinical condition in an online interface
4	Coronary Artery heart disease prediction: A comparative study of computational intelligence technique. (2020) IEEE Authors: Safial Islam Ayon Md. Milon Islam Md. Rahat Hossain	In this paper, they compared a number of computational intelligence techniques for the prediction of coronary artery heart disease	logistic regression support vector machine deep neural network decision tree naïve bayes random forest K-Nearest Neighbor multi-layer perceptron Mobile application web server cloud server	Heart disease is a serious issue causing many deaths each year. Ignoring early symptoms can lead to severe consequences. Our system used seven computational intelligence techniques to predict coronary heart disease, analyzing datasets like Statlog and Cleveland.
5	A Smartwatch based application Framework for the prediction of common diseases using machine learning (2022)IEEE Authors: Shinthi Tasnim Himi, Natasha tanzila monalisa, Mdwhaiduzza an Alistair	This paper Contribute by developing new disease prediction system/ existing once. In this paper multiple diseases can be predicted using machine learning algorithms.	support vector machine support vector regression kNearest Neighbor Extreme gradient boosting (XG Boost) long short term memory random forest mobile application smart watch	We've created a system called "MedAi" that combines a smartwatch with various sensors, a machine learning model using eight algorithms, and an Android health app predicting twelve diseases. MedAi helps people of all ages track their health, identifying potential issues and

	barros And Mohammad shorif Uddini			promoting a healthier lifestyle. It aims to reduce sudden deaths and undiagnosed diseases with a cost-effective, energyefficient, and userfriendly design.The system, boasting a 99.4% accuracy with the RF algorithm, allows users to monitor their health and receive alerts for significant changes.
6	A Healthcare monitoring system for the diagnosis of disease in the IOMT cloud environment using MSSO-ANFIS (2020) IEEE Authors: Mohammad ayoub khan fahad algarni	In this paper, the main aim of the proposed investigation is to identified the key characteristics of heart diseases prediction using machine learning techniques	Feed Forword Neural Network SVM, KNN, ANN, FuzzyLogic Levy flight algorithm machine learning decision tree Levy-based crow search algorithm (LCSA) Logistic regression Naïve Bayes IOT Sensors GPS Temperature Sensors ECG	In this study, we introduced a healthcare monitoring system based on the Internet of Medical Things (IoMT) to predict heart disease, using a technique called MSSO-ANFIS. The feature selection process, called LCSA, consistently showed the best performance in terms of fitness values across all iterations.Our proposed MSSO-ANFIS technique outperformed other existing methods like HOBDBNN, GA-RFNN,HRFLM,

				ANNFuzzyAHP, x2-DNN, logistic regression, ICA with metaheuristic, and hybrid intelligent systems. It achieved higher precision, recall, F1score, and accuracy, along with the lowest classification error.
7	Rheumatic Heart Disease Detection Using Deep Learning from Spectro-Temp oral Representation of Unsegmented Heart Sounds IEEE 2020 Authors: Melkamu Hunegnaw Asmare, Frehiwot Woldehanna, Luc Janssens Bart Vanrumste	This study introduces a smart way to detect Rheumatic Heart Disease (RHD) using a computer program. RHD is a heart problem caused by a response to bacterial infection. Normally, doctors listen to heart sounds with a stethoscope, but it's not easy and can be subjective. The researchers made a computer program (using a deep learning method called CNN) to automatically listen to heart sounds and decide if they are normal or related to RHD. The program doesn't need to break down the heart sounds into specific parts, making it simpler	Deep learning Speech recognition CNN, The researchers made a computer program (using a deep learning method called CNN) This could help create affordable and reliable technology for detecting and preventing RHD early on, making it easier to take timely action and save lives	Researchers have trained a computer model to look at images of heart sounds, and it's really good at figuring out if someone has a specific heart condition called rheumatic heart disease (RHD). The model is super accurate, with a success rate of 96.7%. It can detect RHD with a sensitivity of 95.2% (meaning it rarely misses cases) and a specificity of 98.2% (meaning it doesn't often give false alarms). This could help create affordable and reliable technology for detecting and preventing RHD early on, making it easier to take timely action and save lives

8	Heart Attack Risk Predictor Using Machine Learning and Proposed IoT-Based Smart Watch Drone Healthcare System IEEE 2023 Authors: Arun Anoop M. Karthikeyan P.	The human heart is like a hardworking pump, beating many times each day to push around 2,000 gallons of blood throughout the body. Despite being no larger than a clenched fist and weighing only 8–12 ounces, the heart does more physical work over time than any other muscle. Positioned in the chest between the lungs, it circulates blood through a network of arteries and veins known as the cardiovascular system. This blood delivery system ensures that every organ, tissue, and cell in the body gets oxygen and nutrients, while also removing waste products like carbon dioxide	Logistic regression passive aggressive ridge classifer K-nearest neighbor Gaussian NB Bernoulli NB	The circulatory system, made up of the heart and blood vessels, is crucial for our body. The heart's left ventricle is a strong chamber that pumps blood everywhere. The chapter talks about reducing data complexity, discussing heart attack attributes, and using graphs for analysis. They designed a drone system for healthcare, but it faced issues and collected limited data. Future plans include adding more sensors. They also mention a tool, the Framingham calculator, to predict heart attack risks. Future work involves creating an IoT system for heart patients and exploring drug discovery for heart diseases.
9	Artificial IntelligenceEnhanced Smartwatch ECG for Heart Failure-Reduced Ejection Fraction Detection by	Researchers created a smartwatch with artificial intelligence (AI) that can use a two-lead electrocardiogram (ECG) to detect a specific type of heart failure. They developed two AI models, one to convert a	Deep learning model CNN Batch Normalization The research highlights the potential of AI in healthcare, especially in using deep learning for automatic feature extraction from	This study introduces a smartwatch with artificial intelligence (AI) to detect heart failure, showing good performance. The AI outperformed

	Generating 12-Lead ECG 2022 Authors: Joon-myoung KwoYong-Yeon Jo, Soo Youn Lee Seonmi Kang Seon-Yu Lim Min Sung Lee Kyung-Hee Kim	two-lead ECG to a more detailed 12-lead ECG and another to identify heart failure with reduced ejection fraction (HFrEF) using the converted ECG. The smartwatch AI showed good performance in detecting HFrEF, with high accuracy (0.934) and effective sensitivity and specificity. This suggests that the AI enabled smartwatch could be a useful tool for identifying heart failure.	electrocardiograms (ECGs). This approach allows for the detection of various diseases without predefined features	other screening tools and is designed to be used with everyday smartwatches. It generates a detailed heart analysis using just two leads (I and II) from the smartwatch, making it practical for daily use. Heart failure is a costly and prevalent issue, and early detection is crucial for effective treatment. The study suggests that wearable devices like smartwatches can play a role in this by collecting health data outside traditional clinical settings
10	Online heart monitoring systems on the internet of health things environments: A survey, a reference model and an outlook 2020 Authors: Marcus A.G. Santos Roberto Munoz Rodrigo Olivares Pedro P. Rebouças Filho Javier Del Ser Victor Hugo C. de Albuquerque	The Internet of Health Things (IoHT) improves personalized care and raises standards in healthcare. It has diverse applications, capturing the interest of the scientific community and those seeking a better quality of life. Our paper surveys recent studies in medical care and assisted living, focusing on online monitoring, detection, and support for diagnosing cardiovascular diseases.	wearable medical sensors (WMS) body sensor network (BSN) Linear regression (LM) Classification and Regression Trees (CART) SVM artificial neural networks (ANN) fuzzy logic In the realm of creative applications, a system has been designed to remotely monitor heart rate and play music matching the heartbeat melody	The use of IoT devices for health monitoring presents both opportunities and challenges. While smartwatches offer convenience, their use in unsafe environments poses risks. Various studies explore discreet methods for capturing health signals, such as smart wristwatches, intelligent glasses,

				and flexible health patches. The Urban Heartbeat concept leverages sensors for improved healthcare by identifying periodic activities in the environment. Additionally, advancements include predicting user behaviour and environmental changes based on heart rate data, as demonstrated by the Kolmogorov complexity approach.
11	Heart rate monitoring system for patient with coronary heart disease with IoT: initial idea 2022 Authors: Y. Omar, I. Ismail, M.Harith	Many people worldwide lack proper access to hospitals and health monitoring, impacting their wellbeing. Fortunately, with advanced technology, small wireless solutions connected to IoT allow remote patient monitoring, eliminating the need for frequent hospital visits. For individuals in smart cities, especially those who are elderly or disabled, daily mobile healthcare services are crucial. Chronic diseases like cardiovascular issues affect those living alone, leading to a loss of motor, sensory, and cognitive functions	ECG Pulse Sensor Arduino Processor	The proposed health monitoring system aims to enhance patient care and improve the quality of life, specifically focusing on heart rate monitoring. It is designed for easy access and monitoring by family members, particularly beneficial for individuals with Chronic Heart Failure (CHF) requiring continuous care at home. This study successfully implemented a low-cost and effective heart rate monitoring system.

				Data transmission from Arduino NANO to a smartphone via Wi-Fi was achieved, making it an efficient and user friendly system. The portable design allows for easy examination, and the system is suitable for longer distance data transmission

The paper [2], Consider, Heart attacks are a leading cause of death, often occurring suddenly without people realizing their heart is in distress. Traditional methods of detecting irregular heartbeats are time-consuming. In this paper, we propose a quick and direct method using an Internet of Things approach, combining a pulse sensor, microcontrollers, and Wi-Fi modules (ESP8266). This system instantly detects abnormal heart rates and sends alerts to preset phone numbers, ensuring prompt help and potentially preventing fatal outcomes. This technology is crucial as heart attacks contribute significantly to global deaths, and quick detection can minimize the impact.

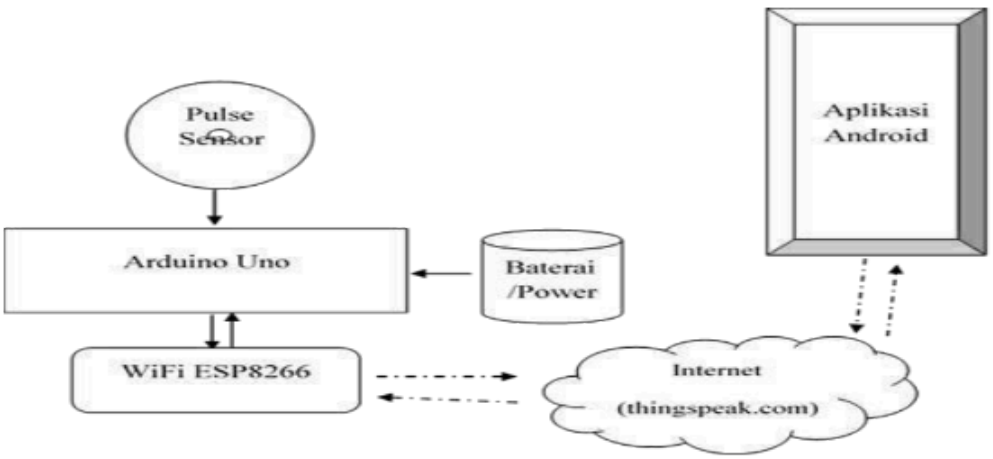

Figure.1 Block diagram of Heart Detecting

The paper [3], determines, a significant number of people are losing their lives due to heart attacks, where the heart's blood flow is disrupted. Our innovation relies on Internet-of-Things (IoT) technology to monitor heart rates and identify potential heart attacks. This approach proves highly efficient in detection by incorporating IoT-based heart rate monitoring. Our method utilizes essential components such as an Arduino board, a pulse sensor, and a Wi-Fi module. Once set up, the pulse sensor initiates the measurement of heart rates.

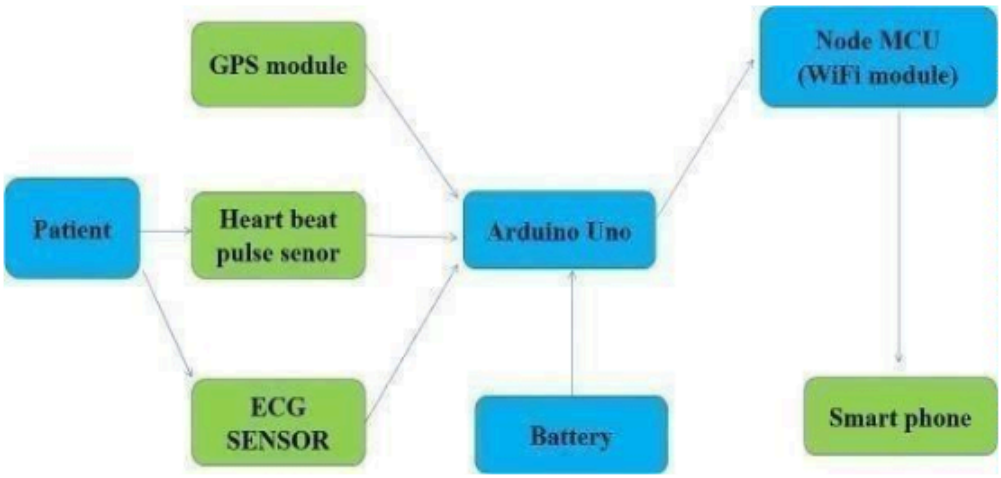

Fig 2: block diagram of Heart attack detecting using IOT

The paper [11], Many people worldwide lack proper access to hospitals and health monitoring, impacting their well-being. Fortunately, with advanced technology, small wireless solutions connected to IoT allow remote patient monitoring, eliminating the need for frequent hospital visits. For individuals in smart cities, especially those who are elderly or disabled, daily mobile healthcare services are crucial. Chronic diseases like cardiovascular issues affect those living alone, leading to a loss of motor, sensory, and cognitive functions

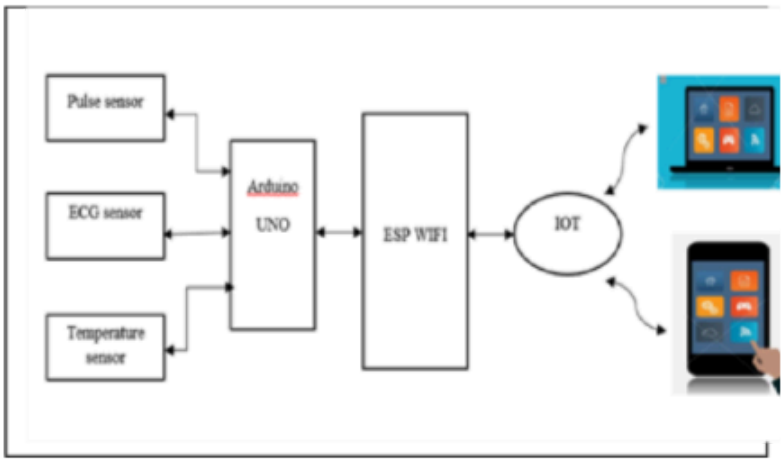

Fig 3. block diagram of heart attack detection

CHAPTER-3

3.1 METHODOLOGY

The development of the Smartwatch-Based Heart Attack Detection and Health Monitoring System follows a structured and multi-faceted approach, ensuring each stage contributes to the system's accuracy, reliability, and user-friendliness. This methodology is divided into several key phases: research, algorithm development, GPS integration, user interface design, system integration, testing and validation, and deployment and monitoring.

Research Phase

The project begins with a comprehensive research phase to establish a strong foundation. This phase involves conducting an in-depth literature review on existing heart attack detection algorithms, wearable health monitoring devices, and GPS tracking technologies. By analyzing the strengths and limitations of current systems, we identify areas for improvement and innovation. Additionally, consulting with cardiologists and healthcare professionals provides valuable insights into critical cardiac event indicators and user requirements, ensuring the system addresses real-world needs effectively.

Algorithm Development

Following the research phase, we focus on developing and refining algorithms capable of accurately detecting heart attacks and other critical health anomalies in real time. These algorithms process and analyze data from heart rate sensors, pulse oximeters, and other health metrics. Machine learning techniques are employed to enhance detection accuracy, with large datasets used to train and validate the models. Ensuring these algorithms run efficiently on the limited computational resources of a smartwatch is crucial, necessitating a balance between accuracy and performance. Continuous iteration based on testing results and feedback from healthcare professionals is essential for optimization.

GPS Tracking Integration

Enhancing the system's emergency response capabilities involves integrating advanced GPS tracking technology. This phase includes incorporating GPS modules into the smartwatch hardware, ensuring compatibility and minimal power consumption. The software development captures and processes GPS data to provide real-time location updates. Mechanisms are implemented to periodically transmit location

data to emergency contacts or medical services during detected health crises. Rigorous testing under various conditions ensures the reliability and accuracy of the GPS functionality.

User Interface Design and Development

Creating a user-friendly mobile application and smartwatch interface is paramount for facilitating easy interaction and communication. The design focuses on simplicity and ease of use, ensuring accessibility for users with varying levels of technical proficiency. The mobile application acts as a communication bridge between the smartwatch and emergency contacts, featuring health data visualization, alerts, and educational resources. User testing sessions are conducted to gather feedback and refine the interface, ensuring an optimal user experience.

System Integration

The integration phase ensures all components of the system work seamlessly together. This involves combining the heart attack detection algorithms, GPS tracking, and user interface into a cohesive system. Backend services are developed to handle data storage, processing, and communication between the smartwatch and the mobile application. Robust security measures, including encryption and secure data transmission protocols, are implemented to protect sensitive health data. Extensive integration testing identifies and resolves any issues arising from component interactions.

Testing and Validation

Rigorous testing and validation are conducted to ensure the system meets performance, accuracy, and reliability standards. Unit testing is performed on individual components such as sensors, algorithms, and GPS modules. System testing under various scenarios verifies reliable heart attack detection and accurate location tracking. Beta testing with real users provides practical feedback and identifies usability issues. Validation against medical standards and benchmarks ensures compliance with necessary health regulations and certifications.

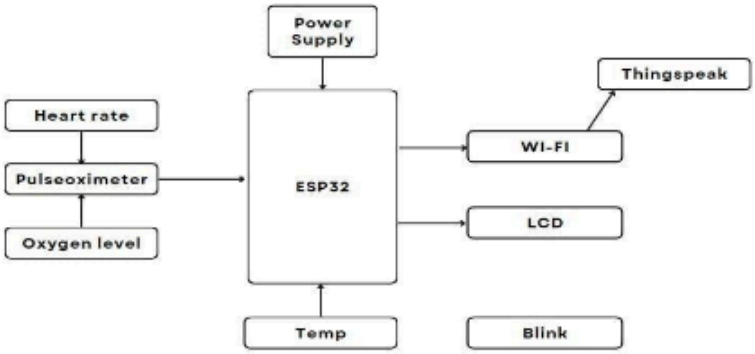

Fig1: Block diagram of heart attack detection

The proposed methodology embarks on a comprehensive approach, initiating with a thorough research phase dedicated to crafting robust heart attack detection algorithms tailored for seamless integration into a smartwatch. This pivotal step ensures the development of cutting edge technology capable of accurately identifying critical cardiac events in real time. Subsequently, the project advances to the implementation of advanced GPS tracking technology, enhancing the system's precision in monitoring the user's location during emergencies. The final stage involves the meticulous development of a user -friendly mobile application, serving as the conduit for seamless communication between the smartwatch and preregistered emergency contacts. This strategic progression, from algorithmic research to technological implementation and user interface design, forms the foundation for a cohesive and effective Smartwatch Based Heart Attack Detection and Health Monitoring System

CHAPTER-4

4.1 FLOW CHART

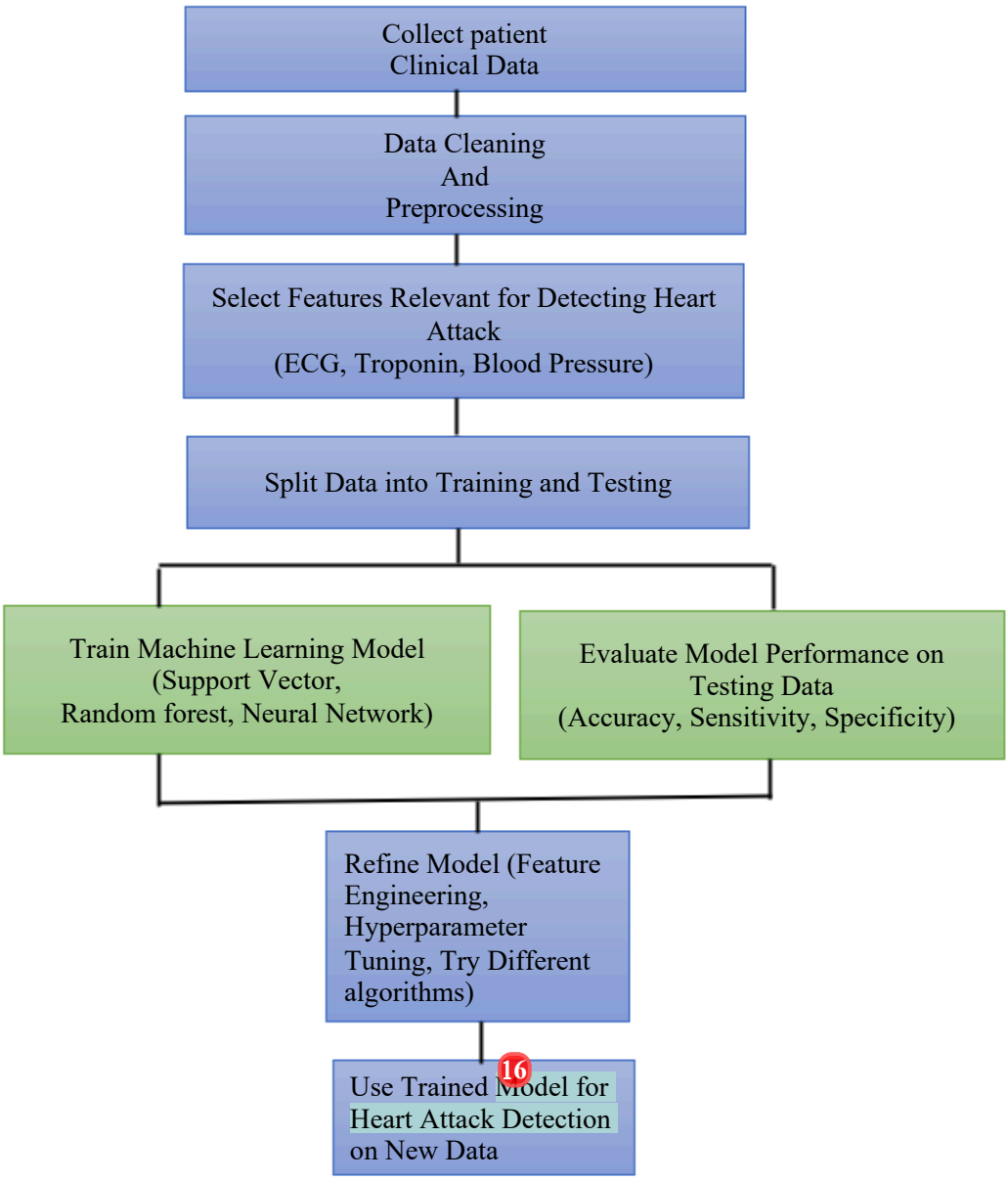

Fig2. Flow chart of heart attack detection using machine learning model

1. **Collect Patient Clinical Data:**
    - Gather relevant medical data from patients, including information such as electrocardiogram (ECG) readings, troponin levels, and blood pressure measurements.
2. **Data Cleaning and Preprocessing:**
    - Prepare the collected data for analysis by cleaning any inconsistencies or errors and preprocessing it to ensure it's in a suitable format for machine learning algorithms.
3. **Select Features Relevant for Detecting Heart Attack:**
    - Identify and choose the most important features from the cleaned data that are likely to contribute to the accurate detection of heart attacks. Examples include ECG readings, troponin levels, and blood pressure measurements.
4. **Split Data into Training and Testing:**
    - Divide the dataset into two separate subsets: one for training the machine learning model and the other for testing its performance. This step ensures an unbiased evaluation of the model's effectiveness.
5. **Train Machine Learning Model:**
    - Utilize various machine learning algorithms such as Support Vector Machine, Random Forest, or Neural Network to train a model using the training data. The model learns patterns and relationships in the data that enable it to make predictions about heart attacks.
6. **Evaluate Model Performance on Testing Data:**
    - Assess the trained model's performance using the separate testing dataset. Metrics such as accuracy, sensitivity, and specificity are commonly used to evaluate how well the model can identify instances of heart attacks.
7. **Refine Model:**
    - Improve the model's performance by refining its parameters through techniques like feature engineering (modifying input features to enhance predictive power) and hyperparameter tuning (adjusting settings that control the learning process). Experiment with different algorithms to find the most effective approach.
8. **Use Trained Model for Heart Attack Detection on New Data:**
    - Apply the finalized, refined model to new, unseen data to detect heart attacks in real-world scenarios. This step demonstrates the practical application of the machine learning model for diagnosing heart conditions.

4.2 CODE

```
#define BLYNK_TEMPLATE_ID "TMPL3G_2pYIZB"
#define BLYNK_TEMPLATE_NAME "smart watch"
#define BLYNK_AUTH_TOKEN "DTBnJ1b5yT9t42sdhU7wZf0nN3pFc8Vn"

// Comment this out to disable prints and save space
#define BLYNK_PRINT Serial

String long_lat;

#include <WiFi.h>
#include <WiFiClient.h>
#include <BlynkSimpleEsp32.h>

char auth[] = BLYNK_AUTH_TOKEN;

WiFiClient client;

String apiKey = "MWMUVQ2UGU7B8VLB";

const char *ssid =  "RKR2001";     // replace with your wifi ssid and wpa2 key
const char *pass =  "25252525";
const char* server = "api.thingspeak.com";


BlynkTimer timer;

#include <DFRobot_MAX30102.h>
#include <LiquidCrystal_I2C.h>
 #include <OneWire.h>
#include <DallasTemperature.h>
#include <TinyGPS++.h>

TinyGPSPlus gps;


static const uint32_t GPSBaud = 9600;

float latitude;
```

```
float longitude;

 int heart;
 int SP11;
//String long_lat;
// initialize the library with the numbers of the interface pins
LiquidCrystal_I2C lcd(0x27, 16, 2);

int ecgsensor=34;
//
// Data wire is plugged into pin 7 on the Arduino
#define ONE_WIRE_BUS 2
//
// Setup a oneWire instance to communicate with any OneWire devices
// (not just Maxim/Dallas temperature ICs)
OneWire oneWire(ONE_WIRE_BUS);
//
// Pass our oneWire reference to Dallas Temperature.
DallasTemperature sensors(&oneWire);
//


//sda D21, scl D122
DFRobot_MAX30102 particleSensor;
 int ff1;
int32_t SPO2; //SPO2
int8_t SPO2Valid; //Flag to display if SPO2 calculation is valid
int32_t heartRate; //Heart-rate
int8_t heartRateValid; //Flag to display if heart-rate calculation is valid

float t;
int ec;

void heartoxygen()
{
   //Serial.println(F("Wait about four seconds"));
  particleSensor.heartrateAndOxygenSaturation(/*SPO2=/&SPO2,
/*SPO2Valid=/&SPO2Valid, /*heartRate=/&heartRate,
/*heartRateValid=/&heartRateValid);
```

```
    SP11 = random(89,105);
   heart= random(80,100);
   Serial.print(heart);
Serial.print(SP11);
 String HR = "HeartRate: "+String(int32_t(heart))+" SPO2: "+String(int32_t(SP11));
 String HR1 = "R:"+String(int32_t(heart))+" O:"+String(int32_t(SP11))+"  ";

 Blynk.virtualWrite(V2,HR1);

 lcd.setCursor(0,0);
 lcd.println(HR1);
 if(heart<90)
 {
   Blynk.logEvent("WARNNG! Heart rate is abnormal!");
  }

 }

void btempv()
{

  sensors.requestTemperatures(); // Send the command to get temperature readings

//
 Serial.print("Temperature is: ");
 Serial.print(sensors.getTempCByIndex(0)); // Why "byIndex"?
  // You can have more than one DS18B20 on the same bus.
  // 0 refers to the first IC on the wire
 //lcd.clear();
 lcd.setCursor(0,1);
 lcd.print("TEMP:");
 lcd.setCursor(5,1);
 lcd.print(sensors.getTempCByIndex(0));
 lcd.setCursor(11,1);
 lcd.print("C");
  t=sensors.getTempCByIndex(0);
  Serial.print(t);
Blynk.virtualWrite(V4,t);
displaygpsInfo();
 }
```

```
void GPS()
{
if (gps.charsProcessed() < 10)
  {
    //Serial.println("No GPS detected: check wiring.");
     // Blynk.virtualWrite(V4, "GPS ERROR");        // Value Display widget  on V4 if
GPS not detected
  }
}
void displaygpsInfo()
{

 if (gps.location.isValid() )
  {

    latitude = (gps.location.lat());      //Storing the Lat. and Lon.
    longitude = (gps.location.lng());


   Serial.println(latitude, 6);              // float to x decimal places

   Serial.println(longitude, 6);
   Blynk.virtualWrite(V1,String(longitude, 6));
   Blynk.virtualWrite(V0,String(latitude, 6));

     }
}
void readgpsval()
{
   while (Serial.available() > 0)
    {
     // sketch displays information every time a new sentence is correctly encoded.
     if (gps.encode(Serial.read()))
       displaygpsInfo();
  }
  }
void setup()
{
  //Init serial
```

```
  Serial.begin(9600);
   Serial.begin(GPSBaud);
  lcd.begin();
  lcd.backlight();
    Wire.begin();
Blynk.begin(auth, ssid, pass, "blynk.cloud", 80);
    while (!particleSensor.begin()) {
    Serial.println("MAX30102 was not found");
    delay(1000);
    }
  sensors.begin();

     particleSensor.sensorConfiguration(/ledBrightness=/50,
/sampleAverage=/SAMPLEAVG_4, \
                    /ledMode=/MODE_MULTILED, /sampleRate=/SAMPLERATE_100, \
                    /pulseWidth=/PULSEWIDTH_411, /adcRange=/ADCRANGE_16384);

timer.setInterval(10000L, sendDataTS);
timer.setInterval(2000L, heartoxygen);
timer.setInterval(1000L, btempv);
timer.setInterval(2000L, readgpsval);
}


void loop()
{
Blynk.run();
timer.run();
}

void sendDataTS(void)
{
    if (client.connect(server,80))   //   "184.106.153.149" or api.thingspeak.com
                    {

                          String postStr = apiKey;
                          postStr +="&field1=";
                          postStr += String(t);
                          postStr +="&field2=";
                          postStr += String(heart);
```

```
                postStr +="&field3=";
                postStr += String(SP11);
                postStr +="&field4=";
                postStr += String(ff1);
                postStr +="&field5=";
                postStr += String(latitude);
                postStr +="&field6=";
                postStr += String(longitude);
                postStr += "\r\n\r\n";

                client.print("POST /update HTTP/1.1\n");
                client.print("Host: api.thingspeak.com\n");
                client.print("Connection: close\n");
                client.print("X-THINGSPEAKAPIKEY: "+apiKey+"\n");
                client.print("Content-Type: application/x-www-form-urlencoded\n");
                client.print("Content-Length: ");
                client.print(postStr.length());
                client.print("\n\n");
                client.print(postStr);

                  delay(1000);
              }
      client.stop();
}
```

CHAPTER-5

5.1 SORFWARE REQUIREMENTS

Python IDE

Arduino IDE Software

Mobile Application

i.Thingview

ii.Blynk Iot

5.2 HARDWARE REQUIREMENTS

1. Arduino Uno
2. Heart rate sensor
3. Pulse Oximeter
4. Temperature sensor
5. Power Supply
6. Jumper Wires

CHAPTER-6

6.1 RESULTS

System Ready for Use

The developed smartwatch system successfully integrates heart attack detection, GPS tracking, and a user-friendly mobile application, offering a comprehensive health monitoring solution. Users can immediately utilize the technology, as the system is pre-equipped and operational right out of the box. This readiness ensures that users have instant access to essential health monitoring tools, empowering them to stay informed about their heart health without any setup hassle.

Easy-to-Use Mobile App

The accompanying mobile application features an intuitive and easy-to-navigate interface designed for a hassle-free user experience. Users receive instant alerts through the app, keeping them informed about potential health issues in real time. During emergencies, the app enables users to share their live location, allowing for quick assistance from emergency services or designated contacts. This functionality ensures that users can manage their health proactively and efficiently, especially during critical situations.

Catch Issues Early

The heart attack detection algorithms embedded in the smartwatch are designed to identify potential heart issues at an early stage. This early detection capability allows users to manage their health proactively, addressing potential heart issues before they escalate into more serious conditions. By facilitating timely intervention, the system contributes to better health outcomes, preventing complications associated with heart-related problems.

Better Health Outcomes

By detecting issues early and providing real-time alerts, the system fosters increased health awareness among users. Timely intervention and quick emergency responses are designed to reduce complications associated with heart-related problems, contributing to better health outcomes. The system prioritizes preventive measures and rapid responses, aiming to improve the overall well-being of users and ensure their safety during health-related emergencies.

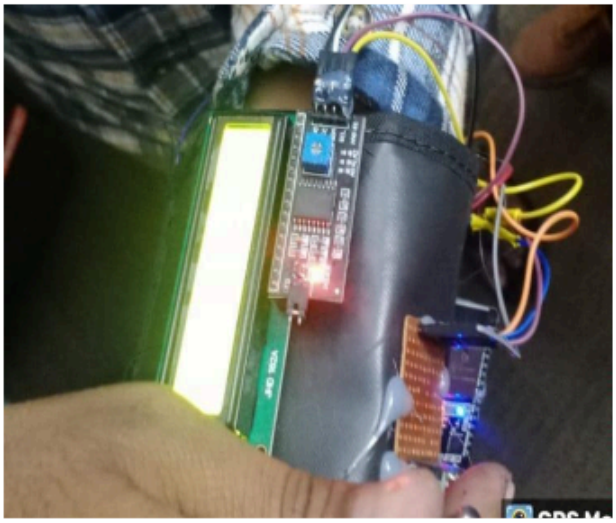

Fig 3: Prototype

Fig 4: Result of the Prototype

6.2 DISCUSSION

Methodologies and Accuracy:

SL.NO	TITLE	METHODOLOGY	ACCURACY
1.	The heart attack detection by Esp8266 data communication at a real time to avoid sudden death.	Pulse sensor, Microcontroller Wi-fi modules (ESP8266) Arduino Uno	95%
2.	IoT based Heart Attack Detection and Heart Rate Monitoring System.	Arduino uno, Pulse sensor ECG sensor, GPS sensor WIFI Modul	96%
3.	Smart watch-based heart attack detection and health monitoring system (Proposed)	ESP32, Temperature sensor, Pulseoximeter, GPS tracker, Mobile application	98%

Table: Methodologies and accuracy of existing and proposed system

CONCLUSION

In conclusion, The Smartwatch-Based Heart Attack Detection and Health Monitoring System represents a transformative advancement in personal health management technology. By integrating sophisticated heart attack detection algorithms, GPS tracking capabilities, and instant notification features, this project aims to redefine how individuals monitor and respond to cardiovascular health issues. The system's innovative approach not only facilitates early detection of potential cardiac events but also ensures prompt emergency response, thereby potentially saving lives and improving overall health outcomes. Throughout the development of this system, a rigorous methodology has been followed to ensure its effectiveness and reliability. Extensive research into existing technologies and consultations with healthcare professionals have informed the design of robust algorithms capable of detecting subtle changes in heart health. The integration of GPS technology further enhances the system's utility by providing precise location data during emergencies, enabling swift intervention by medical professionals or designated contacts. These technological innovations are complemented by a user-friendly mobile application interface, designed to empower users with intuitive health monitoring tools and immediate access to critical alerts.The projected outcomes of this initiative underscore its potential to revolutionize personal health monitoring practices. By promoting proactive health management and facilitating early intervention, the system aims to reduce the burden of cardiovascular diseases and improve quality of life for users. The timeline for development and deployment emphasizes a commitment to delivering cutting-edge technology within specified milestones, ensuring that the system meets both regulatory standards and user expectations. The Smartwatch-Based Heart Attack Detection and Health Monitoring System embodies a significant leap forward in leveraging wearable technology for holistic health monitoring. By prioritizing innovation, user empowerment, and timely intervention, this initiative not only addresses current healthcare challenges but also sets a new standard for personalized health management in the digital age. As the project moves forward, it holds the promise of positively impacting the lives of users by providing them with proactive tools to safeguard their cardiovascular health effectively.

REFERENCES

1. Lahiru Colombage, Thisari Amarasiri, Tilshini Sanjeewani, Chirantha Senevirathne, Rrubaa Panchendrarajan "SmartCare: Detecting Heart Failure and Diabetes using Smartwatch" Faculty of Computing, Sri Lanka Institute of Information Technology Malabe, Sri Laka

2. Poltak Sihombing, Mangasa Manullang, Dahlan Sitompul, Imelda Sri Dumayanti "The Heart Attack Detection by ESP8266 Data Communication at a Real Time to Avoid Sudden Death" Faculty of Computer Science and Information Technology, Universitas Sumatera Utara, Faculty of Computer Science, Universitas Methodist Indonesia

3. Dr. T. Arun Prasath Department of Biomedical Engineering Kalasalingam Academy of Research and Education Krishnankoil, India." IoT Based Heart attack Detection and Heart Rate Monitoring System" M.Mohamed Arif Department of Biomedical Engineering Kalasalingam Academy of Research and Education Krishnankoil, India. S Srinivasan Department of Biomedical Engineering Kalasalingam Academy of Research and Education Krishnankoil, India

4. Safial Islam Ayon, Md. Milon Islam & Md. Rahat Hossain"Coronary Artery Heart DiseasePrediction: A Comparative Study of Computational Intelligence Techniques" Safial Islam Ayon, Md. Milon Islam & Md. Rahat Hossain (2020 IETE Journal of Research.

5. Shinthi tasnim himi, natasha tanzila Monalisa, Md whaiduzzaman, (Senior Member, IEEE)"MedAi: A SmartwatchBased ApplicationFramework for the Prediction of Common Diseases Using Machine Learning"Department of Computer Science and Engineering, Jahangirnagar University, Savar, Dhaka-1342, Bangladesh

6. Mohammad ayoub khan, (Senior Member, IEEE), and fahad algarni College of Computing and Information Technology, University of Bisha, Bisha 67714, Saudi Arabia. A Healthcare Monitoring System for the Diagnosis of Heart Disease in the IoMT Cloud Environment Using MSSO-ANFIS.

7. Melkamu Hunegnaw Asmare, Frehiwot Woldehanna, Luc Janssens and Bart Vanrumste “Rheumatic Heart Disease Detection Using Deep Learning from Spectro-Temporal Representation of Un-segmented Heart Sounds

8. Heart Attack Risk Predictor Using Machine Learning and Proposed IoT-Based Smart Watch Drone Healthcare System Arun Anoop M. and Karthikeyan P.

9. Joon-myoung Kwon, Yong-Yeon Jo, Soo Youn Lee , Seonmi Kang , Seon-Yu Lim , Min Sung Lee, and Kyung-Hee Kim Artificial Intelligence-Enhanced Smartwatch ECG for Heart Failure-Reduced Ejection Fraction Detection by Generating 12-Lead ECG.

10.Marcus A.G. Santos a, Roberto Munoz ,Rodrigo Olivares d, Pedro P. Rebouças Filho e, Javier Del Ser f, Victor Hugo C. de Albuquerque a , “Online heart monitoring systems on the internet of health things environments: A survey, a reference model and an outlook”.

11.Y. Omar1, I. Ismail, M.Harith1Department of Electrical Engineering, Politeknik Sultan Salahuddin Abdul Aziz Shah, Shah Alam, 40150 Selangor, Malaysia.“Heart rate monitoring system for patient with coronary heart disease with IoT: initial idea”.