Sree Narayana Guru College of Engineering & Technology

CHALAKKODE P.O., KOROM, PAYYANUR, KANNUR-670 307

MINI PROJECT

MINI PROJECT REPORT
On the title

"IKSHANA"

Report submitted in partial fulfillment of the Requirements for the Award of the Degree of

BACHELOR OF TECHNOLOGY

in

COMPUTER SCIENCE AND ENGINEERING

By

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DEPARTMENT OF COMPUTER SCIENCE AND ENGINEERING

SREE NARAYANA GURU COLLEGE OF ENGINEERING & TECHNOLOGY

AFFILIATED TO A P J ABDUL KALAM TECHNOLOGICAL UNIVERSITY, KERALA

2022-2023

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CERTIFICATE

This is to certify that the Mini Project report entitled **IKSHANA** submitted by **ANIRUDH SHAJI (SNC20CS014), ANURAG MT (SNC20CS016), PARTHIP K ANISH (SNC20CS035) AKASH SUNIL KUMAR (SNC20CS008)** in the partial fulfillment for the award of the Degree of Bachelor of Technology in Computer Science and Engineering to **APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**, KERALA, is a record of bonafide work carried out under my guidance and supervision.

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MINI PROJECT OBJECTIVE

The main objectives of this project are :

- Stay Informed: Access and classify the latest news related to disaster management, empowering users with up-to-date information on ongoing events.
- Receive Timely Help: Receive immediate and targeted emergency assistance during disaster events, ensuring critical needs are addressed promptly.
- Visualize Impact: Utilize live maps with satellite and radar images to visualize disaster-affected areas, aiding in understanding the extent of the event.
- Plan and Respond: Utilize live weather forecasting to make informed decisions and adapt disaster response strategies based on real-time meteorological data.
- Access Critical Contacts: Quickly access essential contact information for local authorities, emergency services, and aid organizations.
- Instant Guidance: Interact with a quick assistance bot for rapid responses and guidance during emergencies, enhancing user confidence and preparedness.
- Assess Health Risks: Monitor air quality indices to assess potential health risks associated with air quality, ensuring safety during and after disasters.
- Engage and Contribute: Participate in disaster relief efforts by volunteering, exploring partnership opportunities, and supporting disaster management initiatives through donations.

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MINI PROJECT OUTCOME

Our mini project has reached a significant milestone with the successful implementation of a dynamic and interactive functionality within our disaster management web application. By seamlessly integrating HTML, CSS, and JavaScript, our web application now boasts an intuitive map interface that empowers users to precisely define specific geographic regions. This innovation is further enriched through real-time data integration, enabling live updates on weather conditions, air quality indices, and timely disaster alerts to be seamlessly overlaid onto the chosen regions. This pioneering addition equips users, including emergency responders and individuals, with the tools needed to make informed decisions tailored to distinct geographic areas. The functional prototype of our web application aptly showcases the potential impact of this feature, highlighting its capacity to elevate disaster management strategies and contribute to more effective responses during critical times. This achievement not only underscores the transformative power of technology in revolutionizing disaster preparedness and response, but also sets the stage for future expansions and refinements within the application, reinforcing its role as a valuable asset in fortifying communities and ensuring their resilience.

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ABSTRACT

web application designed to transform the landscape of disaster management. By harnessing the capabilities of modern web technologies, the application delivers a dynamic platform for real-time incident reporting, efficient resource allocation, streamlined communication, and insightful data visualization. It caters to a diverse range of stakeholders including governmental bodies, first responders, non-governmental organizations, and the general public. With features that encompass instantaneous incident updates, intelligent resource deployment, integrated communication channels, interactive geospatial mapping, and seamless cross-device access, this application stands as a beacon of innovation in the realm of disaster response. Through the implementation of role-based user permissions and the ability to analyze historical data, the platform fosters collaborative efforts, empowers informed decision-making, and significantly bolsters the efficiency of disaster management protocols, resulting in the reduction of casualties and mitigation of damages on a larger scale.

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LIST OF FIGURES

LIST OF ABBREVIATIONS

SYMBOL	DESCRIPTION
HTML	HYPERTEXT MARKUP LANGUAGE
CSS	CASCADING STYLE SHEETS
JS	JAVASCRIPT
APP	APPLICATION
ECMA	EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION
ISO	INTERNATIONAL STANDARDS ORGANIZATION

CHAPTER 1

INTRODUCTION

Welcome to "Ikshana" – Your Comprehensive Disaster Management Companion

In an era where rapid and accurate response to disaster events is paramount, "Ikshana," brought to you by IKSHANA, a nonprofit organization founded in 2023 as a first responder to disasters, emerges as a cutting-edge web application designed to revolutionize disaster management. With a suite of advanced features, "Ikshana" aims to empower emergency responders, aid organizations, and communities with real-time insights and tools for effective disaster preparedness, response, and recovery.

Classification of Latest News Based on Disaster Management:

"Ikshana" leverages state-of-the-art natural language processing techniques to categorize and analyze the latest news articles related to disaster events. By swiftly classifying news content into distinct disaster categories such as earthquakes, floods, wildfires, and more, the application provides stakeholders with a comprehensive understanding of ongoing disaster situations. This feature enables quicker decision-making and targeted resource allocation, ensuring that the right assistance reaches the right places at the right time.

Emergency Needs Assessment:

In the midst of a disaster event, understanding the immediate needs of affected areas is crucial. "Ikshana" offers a real-time emergency needs assessment module that facilitates the identification of urgent requirements such as medical supplies, food, shelter, and personnel. By streamlining communication between disaster management teams and aid organizations, this feature accelerates the delivery of essential resources, ultimately saving lives and minimizing the impact of disasters.

Live Map with Satellite and Radar Images:

"Ikshana" transforms disaster response by providing a live map enriched with satellite and radar images. This dynamic map offers a visual representation of disaster-affected areas, allowing responders to visualize the scope and intensity of the event. By pinpointing high-impact zones and areas at risk, emergency teams can make informed decisions about deploying resources and prioritizing assistance, leading to more effective and efficient disaster management.

Live Weather Forecasting: Anticipating the evolution of disaster conditions is paramount for successful response efforts. "Ikshana" integrates live weather forecasting data, enabling users to monitor real-time

meteorological information. By tracking weather patterns and potential changes in disaster scenarios, emergency management teams can adapt strategies and allocate resources proactively, mitigating risks and maximizing preparedness.

"Ikshana" presents a variety of services to ensure comprehensive disaster management:

- Emergency Contacts: Access critical contact information for local authorities, emergency services, and aid organizations.
- Quick Assistance Bot: Interact with an intelligent bot that provides rapid responses to common queries and guidance during emergencies.
- Air Quality Index: Stay informed about the air quality in your area, vital for assessing health risks during and after disaster events.
- Volunteer and Partnership: Join hands with Ikshana in disaster relief efforts by volunteering or exploring partnership opportunities.
- Donate Us: Support the noble cause of disaster management by contributing to our initiatives The "Ikshana" platform boasts a clean and user-friendly interface, ensuring ease of navigation and access to critical information even in high-stress situations.

CHAPTER 2

SYSTEM ANALYSIS

The existing approach to disaster management relies on conventional methods, often lacking the technological advancements required for efficient and data-driven responses. The absence of real-time insights and streamlined communication hampers the effectiveness of disaster preparedness and response efforts. Key limitations of the current system include:

- News Monitoring: The reliance on manual monitoring of news and media outlets leads to delays in obtaining crucial information about disaster events.
- Resource Allocation: Without real-time data integration, the allocation of emergency resources can be inefficient and misaligned with actual needs.
- Visual Representation: The lack of interactive maps with satellite and radar images hinders responders' ability to visualize disaster-affected areas accurately.
- Weather Monitoring: Weather forecasting is not seamlessly integrated, making it challenging to adapt strategies based on evolving meteorological conditions.
- Contact Information: Accessing critical contact information for local authorities and aid organizations is often time-consuming and cumbersome.
- Assistance and Guidance: Immediate assistance and guidance during emergencies are limited, leaving individuals without timely support.
- Air Quality Assessment: Lack of real-time air quality data impedes the ability to assess health risks associated with air quality.
- Community Engagement: Limited mechanisms for community involvement and support in disaster relief efforts hinder collective action. Overall, the traditional approach to disaster management exhibits inefficiencies in information dissemination, resource allocation, and community engagement. The absence of advanced technologies hampers the ability to respond effectively to disaster events, underscoring the need for a more integrated and technology-driven solution.

It is in this context that the Ikshana Disaster Management Web Application emerges as a transformative solution, addressing these limitations through its innovative modules and cutting-edge features.

CHAPTER 3

LITERATURE REVIEW

3.1 Machine Learning based Classification of Online News Data for Disaster Management.

The rapid enhancement in information technology has come to the aid of disaster management significantly in the ground works on hazard reduction measures. The involvement of the web has emerged rapidly in hazard detection and reducing its consequences. The web is a repository with abundance of information which can be taken advantage of. This data can be productively put together for identification of hazardous areas, regularly monitoring them, early indication of disaster incidence and preparations for its repercussions. Technologies such as wireless sensor networks deployed in geographic regions which are vulnerable to disasters, yield massive volume of data by monitoring hazard conditions in real time. These sensor data can be used for analysis of disasters as it is credible and structured. But collecting authentic information with regard to a disaster event from the web, for the purpose of disaster management is a demanding task. This materializes the inventiveness of the concept of web crawling or web scraping.

News agencies portray a vital role in assisting the public by broadcasting information that educates them about hazard warnings, hazard preparedness, information about affected areas, and relief organizations. By crawling into such news websites to collect hazard related data and structuring it, will help in prompt decision making under emergency situations. Hence, this research work adopts the crawling approach to extract news data from various news websites related to specific keywords in a disaster management scenario in a standardized manner. The main advantage is that information broadcasted on news websites are credible and authentic when compared to social media information. The proposed work intends to eliminate non relevant content specific to the disaster related scenario from news articles so that only the relevant information can be used for the analytical modules. This rectified data can be shared with local officials, relief organizations and residential associations for preparedness as well as for relief operations. This data may help in identifying the affected areas and the impact of the disaster in some cases, and thus can be utilized for post disaster recovery activities. Another important benefit of this work is that the data obtained from these websites can be utilized for creating a database of the disaster events, which can then be used for aiding in various research related to these disasters. The web crawling technique draws out information effortlessly, but the web is a vast

graph with multiple nodes being pages and edges being its hyperlinks and each page accommodates multitudes of data in the form of articles, images, videos, and advertisements. The central challenge in the whole process of scraping is to be able to identify relevant data. This paper focuses on the development of a focused crawler that scrapes data that is relevant in a disaster scenario. News data justifies the necessity of "right information at the right time" by providing emergency responses which eventually aids in early warnings and aftermath relief. Hence, gathering and structuring news data makes the process of managing disasters effortless.

News articles are generally written in a structure where the most newsworthy information goes in the beginning, followed by some basic facts about the event and finally the least newsworthy information such as a background study, goes at the end. The paper aims to build a crawler that offers only valuable information and filter out the irrelevant ones. Since the system demands extraction of pertinent material from an article, classification of extracted data needs to be accomplished. Among the many methodologies of text classification, machine learning theories are apt for the goal of this paper. Text classification using machine learning is a process of assigning specific tags to free text and is adopted for categorizing, organizing and structuring text in a faster and cost effective way. This methodology can be implemented in far-reaching contexts such as assigning tags for short texts (example: tweets, Facebook posts, news headlines), large texts (example: media articles, blogs), sentiment analysis (example: customer support, brand monitoring), topic labeling and so on. This paper focuses on using the text classification technique using machine learning to structure and classify the massive online news data extracted from the web using web crawling approach with keywords specific to environmental hazards and hence delivering only the relevant information.

II. RELATED WORK

There exists several research works that detail the design of crawlers. A crawler should be efficient enough to use its resources such as processor, bandwidth, memory and storage, effectively. News websites do not just publish articles, but also provide dynamic information for its readers and therefore the crawlers need to be robust, so that not just static information is collected. An online article may not just contain textual content always, but also other types of data including multimedia content such as images, videos, etc., which also conveys certain information related to the disaster events. Such type of contents in an article also need to be extracted for analysis so as to obtain maximum information from the source. Hence crawlers must be extensible so that any kind of data structure can be managed. Most of the literature points out the adversity of extracting relevant information while scraping data from the web. The crawler must be able to identify meaningful information and store it as per the requirements

of the application. Politeness is one of the main characteristics that should be followed by a crawler, so as to make sure that it doesn't degrade the performance of the websites or the web servers. A crawler must follow a politeness policy, so that it doesn't flood a web page with lots of queries and data requests. It is also necessary to check the website's rules on what can be scraped and what not to. Extracting relevant content from an article is as demanding as it is in the case of focused crawlers. In recent times, supervised learning approaches are used extensively due to it's appealing results. The explosion of online data managed to put machine learning approaches in the spotlight in recent times. News articles related to a hazard plot may have considerable amount of information, and in order to filter out meaningful and quality content, text classification with learning approaches can be experimented. In supervised learning, inputs of data and predefined target pairs are used for training a machine learning model so that predictions can be made when the model is exposed to unknown data. The training data contains target values for each data point, which is predefined by following certain judgements as per the requirements of the product. There exists several text classification algorithms such as Naive Bayes, Support Vector Machines, Decision trees, and Multi Layer Perceptrons.

One of the major setbacks of supervised learning approach is its overhead as it takes manual effort in annotating each text and labeling it. Generally more than one annotator is assigned with the job of labeling each text as different interpretations of a text can be analyzed and the labels can be decided as per the best interpretation. In the proposed work's implementation, the annotator reads through each sentence in a news article and identifies the relevant ones. Sentences which delivered details related to a disaster scenario such as the cause of the event, affected areas, casualties or injuries from the event, and any actions taken by government or regional officials, were considered relevant. Sentences which described similar events of the past and interpreting an analysis were considered as irrelevant. By focusing on the above regarding aspects of online data analysis, this research work aims to develop a focused crawler that collects disaster related news articles and potentially filter out irrelevant data by classifying the content of each article using a supervised learning approach.

3.2 Location Based Early Disaster Warning and Evacuation System on Mobile Phones Using OpenStreetMap

Natural Disaster is the consequence of natural hazards such as cyclone, storm, earthquake, tsunami, flood etc. This earth has already observed the destructive mode of nature which has taken millions of lives. The 2011 Japan earthquake and tsunami, the 2010 Haiti earthquake, the 2008 cyclone Nargis, the 2004 Indian Ocean Tsunami, the 1991 Bangladesh cyclone are some recent examples of deadliest natural disasters. Natural hazards generally end up with disasters where the affected areas are

vulnerable. The report of United Nations International Strategy for Disaster Reduction (UNISDR) on Mortality Risk Index (MRI) ranks Bangladesh no. 1 among 200 countries most at risk from earthquakes, floods, tropical cyclones, and landslides. Since Bangladesh is the most natural disaster-prone country, prevention is necessary for protecting lives and properties. Sometimes people may be unaware about the upcoming natural hazards. Lack of preparedness of people causes major damage during disasters. So, adequate prior disaster warning and an effective evacuation system can save a significant number of lives in the country prone to frequent disasters. A newcomer or a tourist and a blind person in a particular area may face the problem in finding a safe area from his current stay during a disaster. Hence, we have proposed a location based early disaster warning and evacuation system on mobile phones using OpenStreetMap which is mainly utilized to provide audio and visual messages on the map. OpenStreetMap (OSM) is a rapidly growing open source map of the world because of the availability of map information across the world and the advent of inexpensive portable GPS devices. This open source OSM has recently been employed in many projects like WikiProject Libya and WikiProject Haiti etc. In the WikiProject Libya, the roads and places of interest were mapped in detail. WikiProject Haiti facilitated the rescue work and helped in providing relief aid after the devastating earthquake in Haiti in 2010 [5]. So, OSM has achieved the popularity to use instead of using restricted Google maps. The demand for location based services is also increasing day by day with the burgeoning growth of smartphones. Our location based system is also an android platform based smart phone application to render location based services showing the warning of upcoming disasters (tsunami, cyclone, and flood etc.) if the user is in the possible disaster affected area or near to that area and demonstrating nearest safe zone or shelters on the map of the application. Our proposed system is developed for both the normal and blind people. The usability of OpenStreetMap (OSM) is ensured for all users as it is free. Users of our application will get both text and audio warning message and evacuation direction on the map. The rest of the paper is organized as follows. In Section II, we discuss about some related works and their shortcomings in brief. Then we present the description of our proposed location based system in Section III. In Section IV, system implementation details are described. In Section V, we have discussed the experimental result. Finally, we conclude this paper stating the future plan in Section VI.

II. RELATED WORK

Early Disaster Warning and Evacuation System is very common disaster management approach in disaster-prone areas of the world. In recent years, efforts in disaster management has gained the impetus from unprecedented development of Mobile Technology. Currently, mobile phones provide

vital support for disaster management in many ways: monitoring, communication, warning dissemination, evacuation, rescue and relief aid. Moreover, the advent of smart phones supporting GPS functions assists in disaster management. To date, different researchers from all over the world have conducted decent number of researches about early disaster management system. Among them, Short Message Service (SMS) is used to collect the upcoming flood warning and send back to all citizens from the server. Here, lots of SMS transfer can cause the network congestion which might impede the voice call communication through the same network. This can make the evacuation process difficult either. In, Cell Broadcasting Service is utilized to directly send messages to the users in a specific area. This is helpful not to cause panic and network congestion as well. However, it still fails to help in evacuation process providing interactive information about shelters and safe areas. GSM alarm device for early disaster warning is proposed to place it in the local police station or fire brigade station. The device gets disaster warning from the weather office and make three different types of warning. The police station or fire brigade station then controls the evacuation process and informs the center about evacuation progress through that device. Again this alarm based early disaster warning system is not a faster way of evacuation though it can avoid the problem of network congestion. Researchers also propose Area Mail disaster information service provided by NTT DoCoMo for tsunami alert and evacuation system with a view to support fishery workers. The area mail service makes it possible to deliver information simultaneously in a limited area among the vulnerable persons to the damage due to disaster. In this service, there is a center monitoring authority that will observe the evacuation progress of the fishing boats and suggest them according to the data came from the fishing boats using a mobile application. This service is a quicker and efficient one. Nevertheless, the service will not work as fast and efficient for the overall population. Developed countries like Australia and South Korea are planning to use satellite communication for disaster management when the mobile network fails. This service will be more reliable, secure, efficient and robust. This service initialization and maintenance are expensive and can not be affordable for developing countries like Bangladesh. Very few researches have been carried out to provide location based services for disaster management on mobile phones. Moreover, the previous works did not distinguish normal people and blind people. Considering the facts, we have presented a location based early warning and evacuation system. Our location based system will forecast impending disasters, disseminate understandable visual and audio warnings to both normal and blind people, demonstrate evacuation guidance in response to the warnings.

III. LOCATION BASED EARLY DISASTER WARNING AND EVACUATION SYSTEM

The disaster management consists of four fundamental steps such as mitigation, preparedness,

response, and recovery. Among these steps, the emphasis of our work is the preparedness which is the development of a system for the action plan of upcoming disasters. For this, we present a location based early disaster preparedness system comprising audio and visual warning and evacuation process on the map of the system for a developing country like Bangladesh.

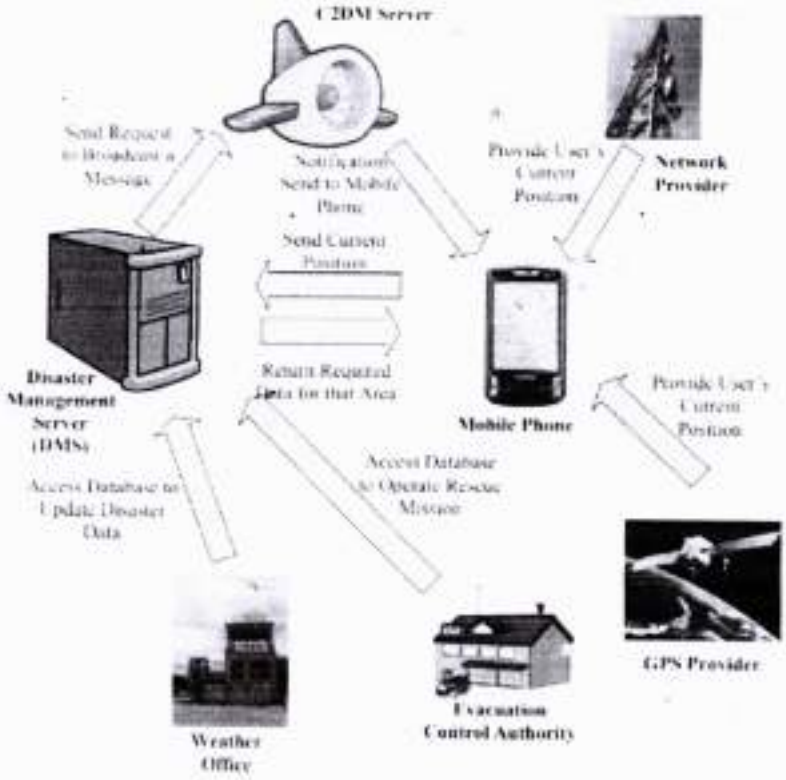
A. Preliminaries

The geographical location of Bangladesh, a South Asian country, situated as it is between the Himalayas and the ocean, on the delta of wide rivers, means that the country is very vulnerable to flooding . The people of coastal areas in Bangladesh have to face several storms each year and cultivable lands disappear in river due to river erosion. Bangladesh is also one of the most susceptible countries to the planet's climate changes. Climate change is producing a growing number of cyclones, and paradoxically, there is a greater risk of drought, as well. The country is also surrounded by the Bay of Bengal which is indeed north-eastern part of Indian Ocean and can ravage the country, particularly the coastal belt sternly. Hence, there is also the risk of Tsunami in this country. However, our disaster preparedness system protects the people of this country from these disasters and uses OpenStreetMap (OSM) because the development of OSM is very rapid. It is dedicated to encouraging the growth, development and distribution of free geospatial data and to providing geospatial data for anyone to use and share. In Bangladesh, the movement of OpenStreetMap started in 2010. The OSM community of Bangladesh is developing the open source of map of Bangladesh since then. This is one of the projects employing their developed map of this country. This proposed work is also implemented on android mobile phones. Android is an operating system for mobile devices such as smart phones and tablet computers developed by Open Handset Alliance led by Google. Android is more open and comprehensive than other mobile operating systems. So, it is the best-selling smart phone platform worldwide. It also allows the developers, wireless operators and handset manufacturer to make new applications and products at lower cost. Theoutcome is more personal and more interactive experience to the users. So, the android mobile platform has been used in our proposed disaster preparedness system.

B. Proposed System

Our proposed location based disaster preparedness system consists of a Disaster Management Server, GPS supported android mobile phones with our proposed application installed on it and users having national id of Bangladesh. Fig. 1 demonstrates the workflow of our proposed location basedearly disaster warning and evacuation system. Disaster Management Server (DMS), a third party server, stores disaster prone areas and the details about the users in its database. Regional weather offices can access the database to update the disaster prone areas. The user of our proposed android application can

also register Android Cloud to Device Messaging (C2DM) server to get notification on application only when there is any update in the database of DMS. Through network provider or GPS provider, mobile phone gets the current location of its user and sends it to server. Using this current position, our system determines whether the user is in probable disaster affected area or not. To do this, the system employs modified version of Ray Casting Algorithm. The user of our proposed application gets early disaster warning message both in visual and audio message on map of the application. The user also gets the shortest path of safe area or shelter zone on the application. The national id of the user is stored in the internal storage of the mobile phone which is sent to DMS later on. Regional evacuation control authority keeps track of the evacuation progress prior to the occurrence of disaster with the help of DMS which expedites the evacuation process and the stored national id of the user. The steps of our proposed system are as follows:



3.3 Food supply chain management in disaster events: A systematic literature review

The food supply chain (FSC) is a network of activities to provide food for society and maintain food security. As with other supply chain scenarios, various actors interact with one another in various FSC stages such as production, processing, distribution, and consumption. FSCs can be disrupted at any of

the stages from the production to consumption. Disruptions in FSCs are defined as any significant breakdown events that affect one or more FSC stages. Disruptions to FSCs can cause economic, social, environmental, and political challenges. Therefore, FSCs are considered critical infrastructure by all governments. Furthermore, FSCs have a crucial place in the achievement of food security and food safety monitoring; hence, preparedness against the risk of disruption in FSC is essential. Some of the greatest risks to FSCs are disasters (man-made or natural), and research has been conducted on FSC management in various disaster events. Nevertheless, the major FSC disruption caused by COVID-19 demonstrated that more challenges in FSC management in major disaster events exist because the vulnerabilities in FSC that were previously invisible or easily solved wererevealed. Hence, substantial research has emerged to address FSC issues resulting from the COVID-19 pandemic. Given the significant growth of research in FSC management in disaster events in recent years, systematic review of the literature on this topic is needed. Furthermore, major disasters are expected to occur more frequently resulting from climate change, making this topic has even more significant. The objective of this article is to conduct a systematic literature review (SLR) on FSC management in disaster events. Our review complements existing reviews on this topic of supply chain resilience in general and FSC disaster management (Table 1). Table 1 also summarises the differences between our article (row 8) and previous review articles (rows 1 to 7). Three articles [4–6] review FSC in the context of disasters. Umar et al. [5] review the literature on FSC resilience against natural disasters, finding that research into FSC resilience in a disaster scenario was in its infancy. However, the number of articles has significantly increased since the start of COVID-19. Furthermore, Umar et al.'s review differs from ours as it is more focused on developing a conceptual framework to understand how an FSC can become more resilient to natural disasters using only content analysis. Manning and Soon [4] review the literature on FSC resilience focusing only on bioterrorism, whereas our review includes multiple disaster types, including bioterrorism. A recent review by Davis et al. [6] discusses FSC resilience from environmental shocks such as algal blooms, pest, coral bleaching, flood, and drought; hence, there is an intersection with our review. However, the research does not cover other major disasters such as outbreaks, bioterrorism, and nuclear accidents. Stone and Rahimifard [9] review articles on FSC resilience, identifying the multidisciplinary aspects of resilience that are applicable to FSC. The scope of the review covers a broader range of disruptions than our review, as we focus on disasters. Reviews by Singh et al. [10]; Mandal [7] and Tukamuhabwa et al. [8] examine overall supply chain resilience; hence, do not focus on FSC and do not engage disruptions from disasters. In summary, our article is among the first to systematically review the literature regarding FSC in disaster events with the longest timespan.

The remainder of this article is organised into four sections. We explain the SLR method applied in this

article in Section 2, followed by an analysis of the articles identified in Section 3. The analysis begins with a discussion of the research objectives and methodologies applied in the articles and a discussion regarding the various threats to FSC from disasters and proposed solutions addressed in the articles. We dedicate a section to examining humanitarian FSC, which is a subset of FSC in disaster events. We end the discussion with a summary of research gaps. Section 4 discusses potential research directions and Section 5 concludes the article.

2. Materials and methods In this review, we adopt the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guidelines for the SLR . PRISMA is chosen as it provides clear guidance for conducting a SLR [12]. PRISMA also improves methodological and reporting quality. Fig. 1 presents the steps taken in the selection of articles for review. For the identification phase, we selected Scopus, Web of Science and EBSCOHost database for our literature search. We limited our search for articles that were (1) published in peer-reviewed journals, (2) written in English, (3) related to FSC and (4) related to disaster. We searched the following words in the title, abstract and keywords of the articles to satisfy the third and fourth criteria: ('food supply chain' OR 'food logistics') AND (outbreak' OR bioterrorism OR disaster OR earthquake OR flood OR 'extreme temperature' OR drought OR wildfire OR cyclone OR storm OR 'wave surge' OR epidemic OR endemic OR pandemic OR 'insect plague' OR 'animal plague'). In this phase, we identified 396 articles. The 396 articles were then filtered to remove duplications, identifying 111 duplicated articles and resulting in 285 unique articles to be further processed in the screening phase. In the screening phase, two co-authors independently reviewed titles and abstracts of the 285 identified articles to ensure that the articles were related to FSC (the third criterion) and disaster (the fourth criterion). To minimize subjectivity, we used the following procedure. An article would move to the next phase when the two co-authors marked it for inclusion. When an article was only included by one co-author, they discussed it and decided. If they could not reach an agreement, the lead author independently read the abstract and made the final decision. In this phase, we retained 178 articles. In the eligibility phase, we first excluded five articles because the full text was not available. Next, four co-authors read the articles independently to determine whether they were related to FSC and disaster and followed the same exclusion procedure as in the screening phase but based on the full text. An article would move to the next phase when the three co-authors marked it for inclusion. If an article was included by only two co-authors, the lead author made the final decision. From this, we retained the final 122 articles for analysis. The list of the articles is presented in the supplementary material.

Table 1
Differences between relevant literature review articles and our article.

No	Paper	Content Analysis? (Y/N)	Articles Time Span (Year)	Food Supply Chain? (Y/N)	Disasters? (Y/N)
1	[9]	Y	1980–2012	N	N
2	[ ]	Y		N	N
3	[ ]	Y		Y	Y
4	[ ]	Y	2000–2015	Y	Y
5	[ ]	Y	-	Y	N
6	[ ]	Y	2000–2018	N	N
7	[ ]	Y	2008–2019	Y	Y
8	Our article	Y	1974–2020	Y	Y

3.1. Research objectives

The most common research objective, accounting for more than half of the articles, is the assessment of the risk or impact of a disaster on FSC, as shown in Table 2. Risk is associated with the possible effect of a future disaster, whereas impact is associated with the effect of a disaster that has occurred. For example [14], assess the impact of the Bird Flu (H7N9) on the poultry meat supply chain in China, and Yadav and Sharma [15] review the potential risk of bioterrorism attack on FSC. The second most common research objective is proposing an FSC design to manage disruptions from disasters or evaluating the preparedness of an existing FSC for future disasters. The typical performance measures for evaluations include the cost efficiency of the FSC operation (e.g., Refs. [16,17,18]), demand fulfillment (e.g. Refs. [19–21]), and resilience measures (e.g., Ref. [22–24]). Although this is the second most common objective, the number of articles is relatively low for such an important objective, revealing a research opportunity. The next most common objective is research that proposes methods for tracing contaminated food products during foodborne outbreaks. For example, Schlaich et al. [25] propose a calibrated gravity model to identify the source of foodborne outbreaks. Another example is Keeratipibul et al. [26]; presenting a genotyping method called Multilocus Variable Number of Tandem Repeat High-Resolution Melting Analysis (MLV-HRMA) for screening Salmonella contamination. Matta et al. [27] use radio-frequency bio-sensing technology to detect pathogens in contaminated liquid. These technologies can be used to track the source of contami-nation in FSC. In summary, our result shows that the research objective has been dominated by risk or impact assessment. This is understandable because we need to estimate the risk and impact of disasters on FSC before we can make decisions to manage the risk. However, understanding the impact or risk of disaster on FSC alone is not enough. We need more research on finding the best strategies to manage the risk of disaster on FSC.

CHAPTER 4

REQUIREMENT ANALYSIS

SRS forms the basis of software development. The SRS is the official statement of what is required of the system developers. it should include a detailed specification of the system requirement. It helps to check if the software has met the requirements. Hence a high-quality SRS is a prerequisite to high quality software.

HARDWARE: -

Processor : INTEL CORE i3 or above

RAM : 8 GB

Android System :6.0 or above

SOFTWARE: -

OS : All web application

IDE : Visual studio: Visual Studio Code, also commonly referred to as VS Code, is a source-code editor made by Microsoft with the Electron Framework, for Windows, Linux and macOS. Features include support for debugging, syntax highlighting, intelligent code completion, snippets, code refactoring, and embedded Git.

Front end :

HTML: HTML, which stands for Hypertext Markup Language, is the standard markup language used to create and structure content on the World Wide Web. It forms the foundation of web pages and is essential for building and presenting information in a structured manner. HTML uses a system of elements and tags to define the structure and content of a webpage, including headings, paragraphs, links, images, forms, and more.HTML documents consist of a series of elements that are enclosed within opening and closing tags. These elements provide structure and semantics to the content, allowing web browsers to interpret and display the content appropriately. For example, the `<h1>` tag is used to indicate the main heading of a page, while the `<p>` tag is used to define paragraphs of text.

Over the years, HTML has gone through various versions, with HTML5 being the most recent major version. HTML5 brought many improvements and new features to web development, including

multimedia support through the '<audio>' and '<video>' tags, better form handling with new input types, enhanced semantic elements like '<header>', '<nav>', and '<article>', and improved support for mobile and responsive design.

HTML is often used in conjunction with other technologies like Cascading Style Sheets (CSS) for styling and layout, and JavaScript for adding interactivity and dynamic behavior to web pages. Together, these technologies form the core building blocks of modern web development, enabling the creation of visually appealing, interactive, and user-friendly websites and web applications.

CSS: CSS, or Cascading Style Sheets, is a vital technology in web development used to define the visual design and layout of HTML documents. By selecting specific HTML elements and assigning properties (such as colors, fonts, margins, and more) with corresponding values, CSS separates the structure of a webpage from its aesthetic presentation. This enhances the maintainability and flexibility of websites, enabling developers to create visually appealing and responsive designs that adapt to different screen sizes. Whether applied inline, internally within the HTML file, or externally in separate CSS files, CSS rules follow a cascading order of precedence and specificity, allowing for precise control over how styles are applied. Additionally, CSS provides tools like Flexbox and Grid for layout management and supports transitions and animations for interactive user experiences.

JAVA SCRIPT: JavaScript is a versatile programming language essential for modern web development, allowing developers to create interactive and dynamic experiences by manipulating webpage content, handling user actions, and communicating with servers. Through the Document Object Model (DOM), JavaScript can modify page structure and elements, while event handling, variables, functions, and loops enable responsive interfaces and logical operations. Asynchronous programming aids tasks like network requests, and its ecosystem of libraries and frameworks simplifies common tasks, although security precautions are necessary due to client-side execution.

CHAPTER 5

PROJECT DESCRIPTION

- News Classification Module: Leveraging advanced natural language processing techniques, this module categorizes and analyzes news articles related to disaster management in real-time, providing users with up-to-the-minute insights for swift decision-making.
- Emergency Needs Assessment Module: In the midst of disaster events, this module enables real-time assessment of urgent requirements, facilitating efficient communication between disaster management teams and aid organizations to expedite the delivery of essential resources.
- Live Mapping Module with Satellite and Radar Images: The application's dynamic live map is enriched with satellite and radar images, equipping responders with a visual representation of disaster-affected areas for resource allocation and strategic planning.
- Live Weather Forecasting Module: Seamlessly integrating real-time meteorological data, this module empowers users to monitor evolving weather conditions, enabling adaptive disaster response strategies and ensuring community safety.
- Emergency Contacts Module: Providing swift access to critical contact information for local authorities, emergency services, and aid organizations, this module ensures seamless communication and coordination during disaster events.
- Quick Assistance Bot Module: An intelligent chatbot stands ready to offer rapid responses and guidance during emergencies, enhancing user confidence and preparedness in critical moments.
- Air Quality Index Module: Monitoring air quality indices in real-time, this module assists in assessing health risks associated with air quality during and after disaster events, enabling informed decision-making.
- Engagement and Support Modules: Encouraging community involvement, these modules enable users to actively participate in disaster relief efforts through volunteering, partnerships, and contributions, fostering collaboration and collective action.

CHAPTER 6

IMPLEMENTATION PLAN

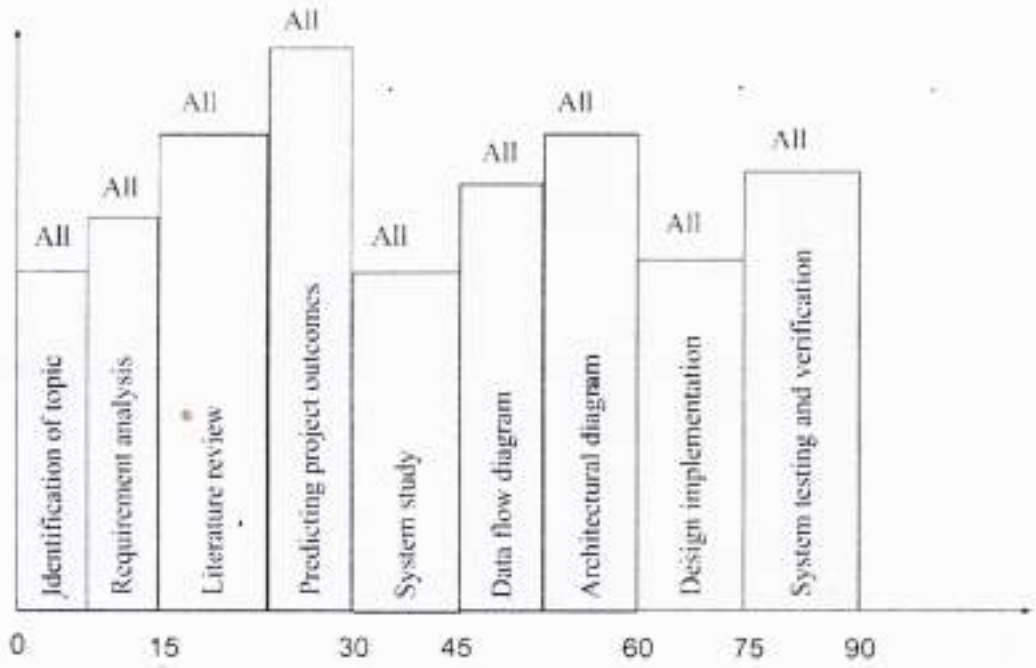


Fig 6.1 Implementation graph

6.1 Identification of topic (0-7 days)

The topic was selected within 7 days . We chose the best , most relevant and easily implementable topic . All the group members took active participation.

6.2 Requirement analysis (8-11 days)

Based on the topic chosen , all the requirements were gathered . Checked whether the requirements were feasible and easy to use.

6.3 Literature review (12-18 days)

Several literature papers were read . Almost 3 papers were read equally by the group members . Compared each paper and used those references to build our system.

6.4 Predicting project outcome (19-24 days)

The outcome of the project was clearly analyzed . The project turned out to be easy and very feasible and beneficial for day-to-day life . The system produced a very convenient method for watering the plants.

6.5 System study(25-29 days)

The system was thoroughly studied along with each part of the system too . The working and usage of the system was studied and analyzed very precisely and also about how the system would be beneficial for the people in their daily lives.

6.6 Data flow diagram (30-35 days)

The data flow diagram of the system was made very clearly . The data flow diagram showed the working of the system, and with the help of this data flow diagram , we can very easily understand the proposed system.

6.7 Architectural diagram (35-40 days)

The architectural diagrams of the system were developed based on the requirement gathering for the system . Made a very precise and efficient architecturial diagram , which showed the full parts of the system.

The stages that are to be condúcted in the phase 2 are

- Design implementation
- System testing and verification

CHAPTER 7

ARCHITECTURE DIAGRAM

Fig 7.1 Architecture diagram

CHAPTER 8

SYSTEM IMPLEMENTATION

Source code :

```
!DOCTYPE html>
<html lang="en">
  <head>
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-scale=1, shrink-
to-fit=no">
    <meta name="description" content="">
    <meta name="author" content="">
    <link
href="https://fonts.googleapis.com/css?family=Raleway:100,300,400,500,700,900"
rel="stylesheet">
    <title>IKSHANA</title>
    <link rel="stylesheet" type="text/css" href="assets/css/style1.css">
    <link rel="stylesheet" type="text/css" href="assets/css/font-awesome.css">
    <link rel="stylesheet" href="assets/css/style2.css">
    </head>
   <body>
    <div id="preloader">
        <div class="jumper">
            <div></div>
            <div></div>
            <div></div>
        </div>
    </div>
header class="header-area header-sticky">
        <div class="container">
            <div class="row">
                <div class="col-12">
                    <nav class="main-nav">
                        <!-- ***** Logo Start ***** -->
```

```
                        <a href="index.html" class="logo">
                            <img                    src="assets/images/logo.png"
alt="IKSHANA"/></a>
                        <ul class="nav">
                            <li><a href="#welcome" class="active">Home</a></li>
                            <li><a href="#features">About Us</a></li>
                            <li><a href="#work-process">Other services</a></li>
                            <li><a href="#testimonials">Testimonials</a></li>
                            <li><a href="#pricing-plans">Donate Us</a></li>
                            <li><a href="#blog">Blog Entries</a></li>
                            <li><a href="#contact-us">Contact Us</a></li>
                        </ul>
                        <a class='menu-trigger'>
                            <span>Menu</span>
                        </a>
                    </nav>
                </div>
            </div>
        </div>
    </header>
    <div class="welcome-area" id="welcome">
        <!-- ***** Header Text Start ***** -->
        <div class="header-text">
            <div class="container">
                <div class="row">
                    <div class="offset-xl-3 col-xl-6 offset-lg-2 col-lg-8 col-
md-12 col-sm-12">
                        <h1><strong>IKSHANA</strong></h1>
                        <p>Helps you navigate through tough times </p>
                    </div>
                </div>
            </div>
        </div>
        <!-- ***** Header Text End ***** -->
    </div>
    <!-- ***** Welcome Area End ***** -->
<section class="section home-feature">
```

```
        <div class="container">
            <div class="row">
                <div class="col-lg-12">
                    <div class="row">
                        <!-- ***** Features Small Item Start ***** -->
                        <div class="col-lg-4 col-md-6 col-sm-6 col-12" data-
scroll-reveal="enter bottom move 50px over 0.6s after 0.2s">
                            <div class="features-small-item">
                                <div class="icon">
                                <i><img       src="assets/images/featured-item-
01.png" alt=""></i>
                                </div>
                                <a    href="maps.html"    class="features-
title"> Live maps</a>
                                <p></p>
                            </div>
                        </div>
                        <div class="col-lg-4 col-md-6 col-sm-6 col-12"
data-scroll-reveal="enter bottom move 50px over 0.6s after 0.4s">
<section class="section padding-bottom-100" id="features">
        <div class="container">
            <div class="row">
                <div class="col-lg-6 col-md-12 col-sm-12 align-self-center mobile-
bottom-fix">
                    <div class="left-heading">
                        <h2 class="section-title">IKSHANA is a nonprofit organization
founded in 2023 as a first responder to  disasters.</h2>
                    </div>
                    <div class="left-text">
                        <p>Throughout history, natural disasters and humanitarian
crises have brought out the humanity in all of us. Mankind bands together to support
their fellow human beings in their time of need.<br>IKSHANA was founded  to provide
hope via a new model for disaster response, one that meets modern crises head-on with
an innovative, adaptable, and scalable approach. One that harnesses strategic
partnerships and empowers local populations in the rebuilding effort.<br>Our work is
made possible entirely by the generous donors and volunteers, who we thank from the
bottom of our heart.</p>
                    </div>
                </div>
                <div class="col-lg-1"></div>
                    <div class="col-lg-5 col-md-12 col-sm-12 align-self-center mobile-
bottom-fix-big" data-scroll-reveal="enter right move 30px over 0.6s after 0.4s">
```

```
                    <img src="assets/images/right-image.png" class="rounded img-fluid
d-block mx-auto" alt="App">
                </div>
            </div>
        </div>
    </section>
    <!-- ***** Features Big Item End ***** -->

    <!-- ***** Home Parallax Start ***** -->
    <section class="mini" id="work-process">
        <div class="mini-content">
            <div class="container">
                <div class="row">
                    <div class="offset-lg-3 col-lg-6">
                        <div class="info">
                            <h1>Services</h1>
                            <p>we offer a wide varierty of services to the world</p>
                        </div>
                    </div>
                </div>

                <!-- ***** Mini Box Start ***** -->
                <div class="row">
                    <div class="col-lg-2 col-md-3 col-sm-6 col-6">
                        <a href="Emergency.html" class="mini-box">
                            <i><img src="assets/images/work-process-item-01.png"
alt=""></i>
                            <strong>Emergency contacts</strong>
                            <span></span>
                        </a>
                    </div>
                    <div class="col-lg-2 col-md-3 col-sm-6 col-6">
                        <a href="airq.html" class="mini-box">
                            <i><img src="assets/images/work-process-item-02.png"
alt=""></i>
                            <strong>Air Quality Index</strong>
                            <span></span>
                        </a>
                    </div>

                    <div class="col-lg-2 col-md-3 col-sm-6 col-6">
                        <a href="medical.html" class="mini-box">
                            <i><img src="assets/images/work-process-item-04.png"
alt=""></i>
                            <strong>Quick Assistance Bot</strong>
                            <span></span>
                        </a>
                    </div>
                    <div class="col-lg-2 col-md-3 col-sm-6 col-6">
```

```
                        <a href="weather.html" class="mini-box">
                            <i><img src="assets/images/work-process-item-05.png"
alt=""></i>
                            <strong>Weather Information</strong>
                            <span></span>
                        </a>
                    </div>
                    <div class="col-lg-2 col-md-3 col-sm-6 col-6">
                        <a href="volnteer.html" class="mini-box">
                            <i><img src="assets/images/work-process-item-06.png"
alt=""></i>
                            <strong>Volunteer & Partnership</strong>
                            <span></span>
                        </a>
                    </div>
                </div>
                <!-- ***** Mini Box End ***** -->
            </div>
        </div>
    </section>
    <!-- ***** Home Parallax End ***** -->

    <!-- ***** Testimonials Start ***** -->
    <section class="section" id="testimonials">
        <div class="container">
            <!-- ***** Section Title Start ***** -->
            <div class="row">
                <div class="col-lg-12">
                    <div class="center-heading">
                        <h2 class="section-title">What do they say?</h2>
                    </div>
                </div>
                <div class="offset-lg-3 col-lg-6">
                    <div class="center-text">
                        <p> Statements from individuals who have experience with
disaster preparedness, response and recovery.</p>
                    </div>
                </div>
            </div>
            <!-- ***** Section Title End ***** -->

            <div class="row">
                <!-- ***** Testimonials Item Start ***** -->
                <div class="col-lg-4 col-md-6 col-sm-12">
                    <div class="team-item">
                        <div class="team-content">
                            <i><img src="assets/images/testimonial-icon.png"
alt=""></i>
```

```
                            <p>"As a resident of an area prone to natural disasters, I
have seen firsthand the importance of disaster management. Thanks to the diligent work
of emergency responders and disaster management teams, my community has been able to
weather storms, floods, and other disasters with minimal damage and loss of life."</p>
                            <div class="user-image">
                                <img src="http://placehold.it/60x60" alt="">
                            </div>
                            <div class="team-info">
                                <h3 class="user-name">Jane Smith</h3>
                                <span>Local Resident</span>
                            </div>
                        </div>
                    </div>
                </div>
                <!-- ***** Testimonials Item End ***** -->

                <!-- ***** Testimonials Item Start ***** -->
                <div class="col-lg-4 col-md-6 col-sm-12">
                    <div class="team-item">
                        <div class="team-content">
                            <i><img src="assets/images/testimonial-icon.png"
alt=""></i>
                            <p>"As a business owner, I know that being prepared for
emergencies is critical to the success and safety of my employees and customers.
Thanks to the support and guidance of  disaster management team, we were able to
develop a  emergency response plan that has helped us through severe weather
events."</p>
                            <div class="user-image">
                                <img src="http://placehold.it/60x60" alt="">
                            </div>
                            <div class="team-info">
                                <h3 class="user-name">John Doe</h3>
                                <span>Business Owner</span>
                            </div>
                        </div>
                    </div>
                </div>

                <!-- ***** Testimonials Item End ***** -->

                <!-- ***** Testimonials Item Start ***** -->
                <div class="col-lg-4 col-md-6 col-sm-12">
                    <div class="team-item">
                        <div class="team-content">
                            <i><img src="assets/images/testimonial-icon.png"
alt=""></i>
                            <p>"As a government official, I have seen how critical
disaster management is to protecting the health and safety of our communities. By
investing in disaster preparedness and response, we can help prevent loss of life and
```

```
property damage, and ensure that our communities can bounce back quickly from
disasters." </p>
                            <div class="user-image">
                                <img src="http://placehold.it/60x60" alt="">
                            </div>
                            <div class="team-info">
                                <h3 class="user-name">Sarah Thompson</h3>
                                <span>Government offical</span>
                            </div>
                        </div>
                    </div>
                </div>
            </div>
        </div>
    </section>
    <!-- ***** Testimonials End ***** -->

    <!-- ***** Pricing Plans Start ***** -->
    <section class="section colored" id="pricing-plans">
        <div class="container" >
            <!-- ***** Section Title Start ***** -->
            <div class="row">
                <div class="col-lg-12">
                    <div class="center-heading">
                        <h2 class="section-title">Donate Us</h2>
                    </div>
                </div>
                <div class="offset-lg-3 col-lg-6">
                    <div class="center-text">
                        <p>Your generosity makes a transformative and lifelong impact.
When you give, you'll join our family of passionate changemakers committed to changing
our world.</p>
                    </div>
                </div>
            </div>
            <!-- ***** Section Title End ***** -->

            <div class="row">
                <div class="col-lg-4 col-md-6 col-sm-12"></div>
                 <!-- ***** Pricing Item Start ***** -->
 <div class="col-lg-4 col-md-6 col-sm-12" data-scroll-reveal="enter bottom move 50px
over 0.6s after 0.2s">
    <div class="pricing-item">
        <div class="pricing-header">
            <h3 class="pricing-title"></h3>
        </div>
        <div class="pricing-body">
            <div class="price-wrapper">
                <span class="currency"></span>
```

```
                <span class="price">DONATE</span>
                <span class="period"></span>
            </div>
            <ul class="list">
                <li class="active">Deliver emergency nutrition.</li>
                <li class="active">Provide water and sanitation supplies</li>
                <li class="active">Provide household & non food items.</li>
                <li class="active">Sponsor a preparedness training</li>
            </ul>

        </div>
        <div class="pricing-footer">
            <a href="donate.html" class="main-button">Donate Now</a>
        </div>
    </div>
</div>
```

CHAPTER 9

SYSTEM TESTING

Test plan is necessary for any project to plan the testing phase and decide the scope of the project. Test plan involves collecting design specifications about the project, wiring test cases, executing them manually or automatically using automated testing tools. Testing any application is highly important. Test plan is a method of documenting the test cases, specification plans and other basic level details about how the application works.

Test Activities for this project includes various testing like:

- Black Box testing: In this project, sample test cases are written and manual testing is done to check the functionality of the application.
- White Box testing: Once the application meets the user requirements and functionalities according to the test cases, its internal logic is completely tested to ensure that the application does not have any logical errors or issues.
- Unit Testing: I have tested all the modules of the application individually by running as a test program.
- Integration testing: After testing the modules individually, tested them by integrating all the sub modules, modules into one application.
- System Testing: It refers to checking whether the system in which the application is built meets the necessary requirements like software support.

For example: In this project, I have checked whether the device in which the application developed is compatible with the software (Android Studio).

- End to End Testing: Tested the complete environment of application by connecting the device with different machines, installing as an APK file, with the database and in the local network.
- Usability Testing: Finally, usability testing is performed by testing the application's flow, UI design, how flexible and easy to use.

CHAPTER 10

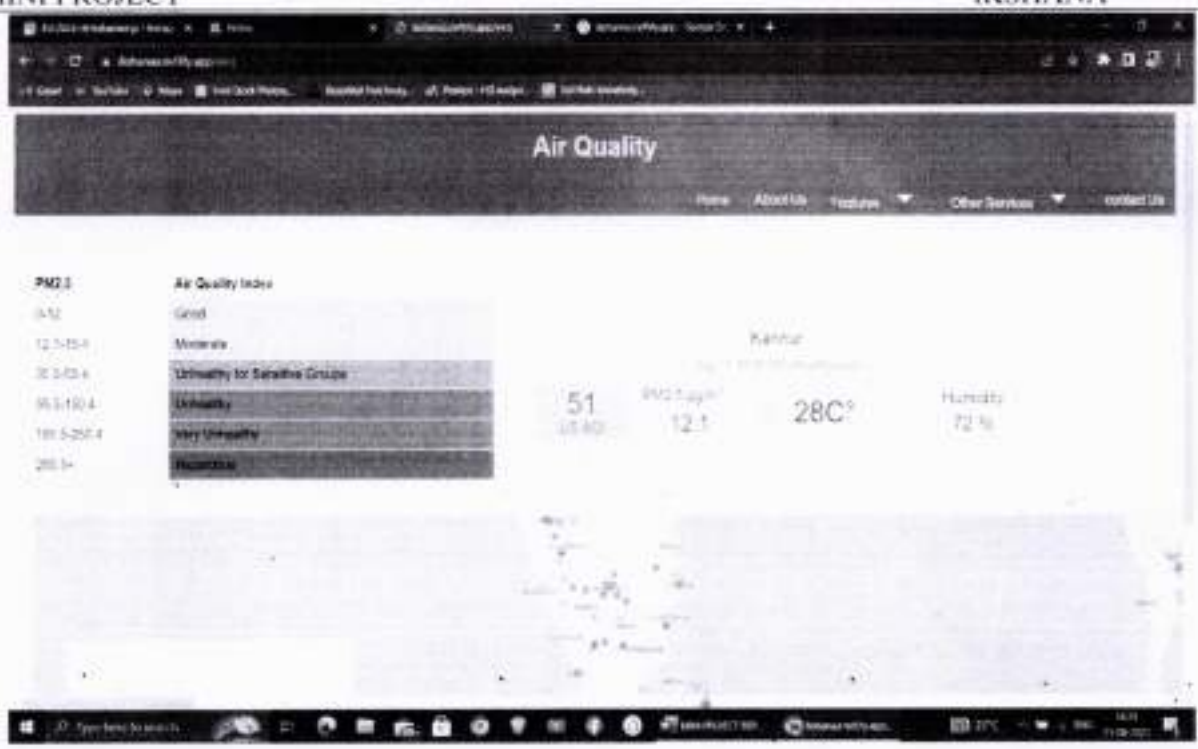
CONCLUSION

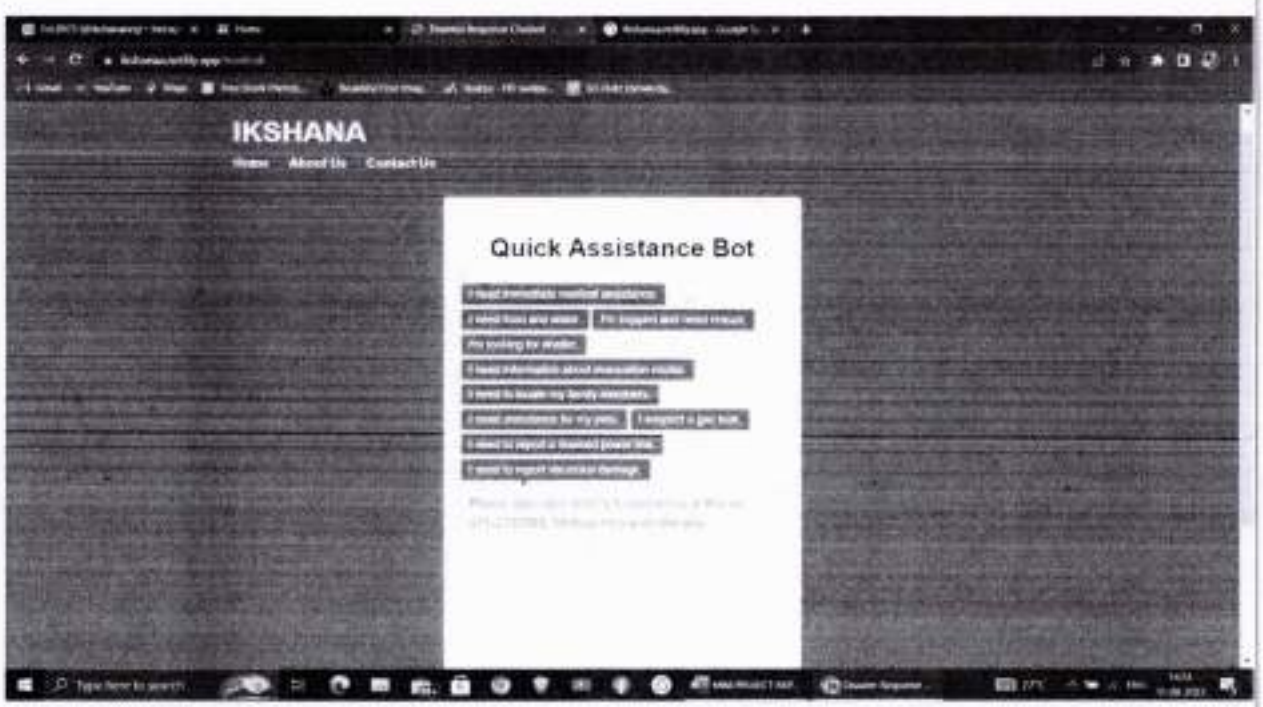
The Ikshana Disaster Management web application stands as a groundbreaking innovation that embodies the fusion of technology, data, and human collaboration in the realm of disaster preparedness, response, and recovery. With an increasingly unpredictable world characterized by a surge in natural and man-made disasters, the need for comprehensive and agile solutions has become paramount. The Ikshana application rises to this challenge by offering an integrated platform that transcends traditional approaches, transforming the way societies address the complexities of disaster management. At its core, Ikshana serves as a hub of knowledge and preparedness, equipping individuals and communities with the tools they need to understand, anticipate, and mitigate the impact of disasters. Through its user-friendly interface, the application disseminates educational content, hazard-specific guidelines, and tailored preparedness plans, fostering a culture of proactivity that reduces vulnerabilities. By empowering users with information, Ikshana aims to minimize the loss of life, protect property, and build resilience in the face of potential crises. The heart of Ikshana's efficacy lies in its real-time data acquisition and analysis capabilities. By collating information from a multitude of sources including sensors, satellites, social media, and official government channels, the application provides a comprehensive situational awareness that enables timely and informed decision-making. Through its data-driven insights, Ikshana facilitates predictive analytics, allowing authorities to anticipate disaster patterns, allocate resources, and strategize response efforts more effectively. Crucially, Ikshana operates on the principle of collaboration, connecting diverse stakeholders involved in disaster management. Government agencies, non-governmental organizations, first responders, and the general public are seamlessly integrated into a shared ecosystem, fostering a cohesive response network. This collaborative approach reduces duplication of efforts, optimizes resource utilization, and ensures that response strategies are unified and harmonious, regardless of organizational or geographical boundaries.

APPENDICES


IKSHANA
Home About Us Contact Us
Volunteer & Partnership
Help us prepare for and respond to disasters by volunteering or partnering with us. Together, we can make a difference.
Volunteer


IKSHANA
Home About Us Contact Us
Get Emergency Contact
POLICE : 100
AMBULANCE : 102
FIRE : 101
DISASTER HELPLINE : 1077
DISTRICT COLLECTOR 0471-2731166,9447700222
DISTRICT POLICE CHIEF 9497990091


Air Quality
Home
About Us
Features
Other Services
Contact Us
PM2.5
Air Quality Index
Unhealthy for Sensitive Groups
Unhealthy
Very Unhealthy
51
12.1
28C°


IKSHANA
Home
About Us
Contact Us
Quick Assistance Bot


WEATHER FORECAST
28°C
search

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(Affiliated to A.P.J Abdul Kalam Technological University and approved by AICTE New Delhi)

Mini Project Report on

PUSHOVER ANALYSIS OF ELEVATED WEATER TANK BY USING SAP 2000

Submitted in partial fulfillment for the award of the degree of the

Degree of Master of Technology In

In computer Aided Structural Engineering

Of

A.P.J Abdul Kalam Technological University

Submitted by

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BONAFIDE CERTIFICATE

*This is to certify that the mini project report entitled "**PUSHOVER ANALYSIS OF ELEVATED WATER TANK BY USING SAP 2000**" is a bonafide record of the work doneby Mrs. **SNEHA C RAJ** of second semester, Department of Civil Engineering, under our supervision, towards the partial fulfillment for the award of the degreeof Master of Technology by A.P.J Abdul Kalam Technological University.*

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ABSTRACT

Elevated water tanks are used within water distribution facilities in order to provide storage and necessary pressure in water network systems. During the occurrence of a severe seismic event, the failure or severe damages in the reinforced concrete shaft could result in the total collapse of the structure. After the design, the water tank were subjected to pushover analysis (non- linear analysis) is obtained by as SAP 2000. Pushover analysis is an advanced tool to user defined non - linear hinge properties or default hinge properties. It is used to evaluate the non - linear behavior and gives the sequence and mechanism of plastic hinge formation. It is used to evaluate the non - linear behavior and gives the sequence and mechanism of plastic hinge formation. Displacement controlled pushover analysis is used to apply the earthquake forces at center of gravity of container.

The main aim of this study was to investigate the nonlinear seismic performance of the innovative elevated water tanks by means of a finite element approach. The capacity spectrum and time history analyses were carried out to understand the nonlinear behaviour of the proposed support system. Conclusion made from the whole analytical study and future scope of the project.

Key words: Elevated RC water tank, nonlinear, SAP2000, finite element analysis, seismic, earthquake, dynamic, modal, pushover, time-history, capacity spectrum

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LIST OF SYMBOLS

Symbols	Representation
ΔF	Incremental Lateral Load
K	Stiffness
ΔU	Incremental Lateral Displacement
Kt	Target Stiffness Matrix
Rt	Restoring Force
$[K]$	Stiffness Matrix
$\{U\}$	Displacement Vector
$[Ki\ T]$	Jacobian Matrix
$\{Fi\ r\}$	Restoring Load

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LIST OF ABBREVIATIONS

ESRs	Elevated Service Reservoirs
FEM	Finite Element Method
SAP	Structural Analysis Program
FEA	Finite Element Analysis
FE	Finite Element
ATC	Applied Technology Council
FEMA	Federal Emergency Management Agency
RC	Reinforced Concrete
CG	Centre of Gravity

CHAPTER 1

INTRODUCTION

1.1 GENERAL

In public water distribution system, Elevated water tanks are generally used being an important part of a lifeline system. Due to post earthquake functional needs, seismic safety of water tanks is of most important. Elevated water tanks also called as elevated service reservoirs (ESRs) typically consists of a container and a supporting tower. In major cities and also in rural areas elevated water tanks forms an Integral part of water supply system. The elevated water tanks must remain functional even after the earthquakes as water tanks are most essential to provide water for drinking purpose. These structures has large mass concentrated at the top of slender which have Supporting structure and hence these structure are especially vulnerable to horizontal forces due to Earthquakes.

In this study the analysis is carried out using FEM (SAP2000.) Software. Seismic analysis is carried out for circular flat base and rectangular type water tank by IS: 1893-1984.In the analysis special moment resisting frames (SMRF) are considered. Elevated water tanks having 500,000 liter capacity. Elevated water tank is analyses for h/d ratios of 0.5, 0.6 and 0.7. After design, the water tanks were subjected to a pushover analysis (nonlinear analysis) which was obtained by as SAP 2000. Performance point is formed in elastic zone in all model shows safety against ductility and collapse. Displacement curves cross target displacement without hinge formation in collapse condition shows safety against ductility and collapse Hence a considered water tank types doesn't need retrofitting.

Fig1.1 Elevated Water Tank

1.2 OBJECTIVE

The objectives of this investigation are to study the behavior of an elevated water tank considering the various structural and geometrical parameters using computer program. Here we shall use Structural Analysis Program (SAP). The final conclusion will be drawn with help of graphs of Base Reaction Versus Displacement (Roof Displacement) and capacity curve for each tank from which we can compare one tank structure with other tank structures and then can predict the behavior of the same.

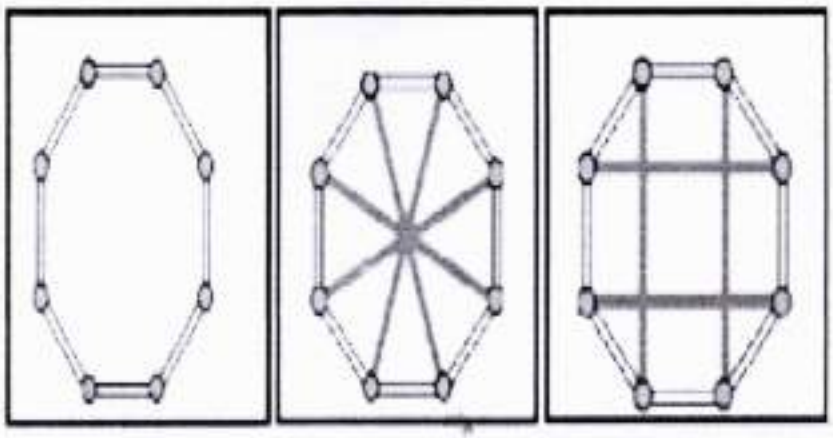
The main objectives are:

To study the behavior of an elevated water tank by 'Pushover Analysis'

1. Base shear, Bending Moment, Axial Force and Displacement for
   a) Constant Staging height and water storage capacity.
   b) Different h/d Ratio.
   c) Number of periphery columns (Eight, Ten, and Twelve).

d) Different types of staging arrangement (Normal, Cross, Hexagonal).

2. Plastic hinge pattern and formation sequence within the staging (for earthquake Zone III)



(a) (b) (c)

Fig.1.2 Different types of staging arrangements: (a) Normal (b) Radial (c)Cross

1.3 METHODOLOGY

This study investigates the behaviour of an elevated water tank by 'Non – Linear Static Analysis'(Pushover Analysis).It is carried out by considering various parameters like water storage capacity and staging height are constant, varying h/d ratio, staging arrangement and variation in number of columns. By inter-combining each of these parameters models of tank were created. All tank models have their locality in earthquake Zone III. A column foundation is to be fixed. Damping ratio of 5% is assumed for all natural modes. Flexural moment (M3), axial biaxial moment (P-M2-M3) and axial compressive shear force (V) hinges are assigned at the face of beam, column, and bracing by using the static pushover analysis. ATC-40 has described the modeling procedure, acceptance criteria (performance level) and analysis procedures for nonlinear static pushover analysis.

CHAPTER 2

LITERATURE REVIEW

Prashant A Bansode in his review paper he entitled seismic analysis of elevated water tank with different staging configuration, he studied the behaviour of different staging system under different tank condition. Response Spectrum Analysis is carried out on three different types of bracing system of elevated water tank for various types of zone by using Staad-Pro v8i 2007. He did comparison of base shear and nodal displacement of elevated water tank for empty and full condition. In his study he got the following result: Base Shear increases as the level of bracing increases because bracing system put an additional mass to the structure ,which result into increase in base shear value. Base moment is found to be increases as the level of bracing increases .Lateral displacement and time period of vibration is reduced considerably because bracing system increases the stiffness of the structure which reduce the lateral displacement.

Cherukupally Rajesh and Sudip Jha in their review paper they entitled the behaviour of elevated water tank for different staging height .In there study they focused on behavior of elevated tank under different load and safer design of structure .They considered changed in wind load behavior of elevated tank with consideration of responses such as base shear , base displacement. Finally study discloses the importance of suitable supporting configuration to remain withstand against heavy damage of elevated water tank during wind load condition Wind load characteristics with different two basic wind speed which causes excitation of responses such as base shear force, overturning moment and roof displacement.

S.S.Quandri in his review paper entitled "Seismic Analysis of RC Elevated Water Tank Using Different Staging Pattern". He considered different parameter like water storage capacity, height of water tower was taken as consistent and variation in number of segment h/d ratio staging arrangement such as normal staging, hexagonal staging ,cross staging and radial staging with central column are considered .he considered all this parameter total 36 models for empty tank , half tank and full tank condition are created .They

worked on staad-pro software based on FEM .The response of each water tower with respect to other will be check for base shear ,axial force , bending moment and lateral displacement .The behavior of water is described with the help of graphs. As the structure is fixed at the base and free at top so there is an increase in stiffness and there is a change in magnitude of lateral displacement base shear.

Hardik V. Patel in his paper entitled analysis of elevated square water tank with different staging system. In his paper he mainly focused on seismic analysis of RCC Square elevated tank using SAP 2000. Using response spectrum analysis compare the result of the base reaction ,joint displacement with different staging system. In his paper he studied about frame type of structure .The main components of frame type of staging are column and braces. In frame staging column are arranged on periphery and it is connected internally by bracing at various levels. In elevated water tank head requirement for distribution of water is satisfied by adjusting the height of the staging portion.

Pranjali N Dhage in her review paper she entitled study on dynamic analysis of RCC elevated water tank. In her paper she considered two cases for same capacity of tank change in geometric feature of container can show change in the response of elevated water tank. In her conclusion she got Static response show high scale value than that of dynamic response .It occurs due to different picks of time period and hydrodynamic factors ignored during the analysis because it will cause collapsed of the structure.

George W Housner in his paper consider three basic condition for analysis of water tank. First he considered full filled water tank without free board then sloshing effect is neglected, then he considered empty water tank then no sloshing as water is absent .Full and empty water tank behave as a one mass structure but in third case water tank is partially filled ,in this case effect of sloshing must be considered.. From above three cases he concluded that fully filled tank is seen maximum force to that of half full tank. He concluded maximum force to which the half full tank is subjected may be significantly less than half the force to which full tank is subjected.

CHAPTER 3

METHODOLOGY

3.1 GENERAL

Finite element analysis (FEA) is the most significant and appropriate computer aided engineering method currently available in industry for realistic structural behaviour simulation without laboratory experiments. Structures, such as elevated water tanks, present excessive difficulties in experimental analysis because of both the required complexity and considerable costs involved with large scale experiments. To avoid this inconveniences FEA have become very popular among researches.

FEA combines areas such as mathematics, physics, engineering and computer science. In practice, a FEA usually consists of three principal steps:

- Pre-processing: This step includes development of a model in which geometry is divided in a number of elements connected by nodes to each other. Material properties, constraints, loads and boundary conditions also should be applied in this stage.
- Analysis: In this step, the geometry, constraints, mechanical properties and loads are applied to generate matrix equations for each element, which are then assembled to generate a global matrix equation of the structure. The equation is then solved for displacements. Using the displacement values, strain, stress, and reactions are calculated.
- Post-processing: The post-processing stage deals with the representation of results. Typically, the deformed configuration, mode shapes, temperature, and stress distribution are computed and displayed at this stage.

Before any further step is taken towards the selection of a methodology that will be followed it is of crucial importance to clarify some important aspects that govern all analytical analysis. In general, mathematical FE models are mostly considered for the purposes of:

- Gaining a true insight to a systems operation
- Developing operating or resource policies to improve system performance
- Enable the extensive testing of new concepts before actual implementation
- Acquiring information without causing a disturbance to the actual system

From the above, the most important purposes for this particular study include enabling the extensive testing of new concepts before actual implementation as well as gaining a true insight to a systems operation. The FEA has a number of advantages as well as disadvantages which are discussed in next sections.

3.2 ADVANTAGES OF FINITE ELEMNET ANALYSIS

A number of important advantages of FEA can be observed for engineering field. One of the main benefits of FEA is an availability of modelling full scale structures and simulate realistic behaviour under various load environments. Once a mathematical model is developed, FE software can analyse the model in detail under variety of loads without damaging a structure or structural elements. In addition, FEA can be performed on computer workstations or personal computers, together with professional assistance.

Advantages of FEA can be summarised as follows:

- Can be used to compress a time frame, a simulation model run on a computer system can be used to investigate quickly the effects of a change in a real life situation that take place over several years.
- Can be used to study complex systems that would otherwise be difficult to investigate.
- Can be used in engineering and product design to investigate the effect of changes without producing a physical model.
- Can be used to investigate situation that would be dangerous in real life.

Furthermore, since computer simulation and modelling tools were developed it is now possible to carry out studies of models for a great variety of researches that would otherwise require excessive complexity in order to be simulated.

Finally, nowadays most FE packages provide some form of result visualisation that allows to make observations, check for logical mistakes and intuitively evaluate results. The ability of analytical simulation, to provide full access to every step of model analysis can be a useful tool that allows to fix both the model and analytical procedure if any problems appear.

3.3 DISADVANTAGES OF FINITE ELEMENT ANALYSIS

Despite the advantageous nature of FE simulation it is important to understand the disadvantages of this type of analysis as well. Those disadvantages are not only directly involved with the modelling and the employed analysis but also with the actual results expected by analysis. Some of these disadvantages were highlighted by Chung:

- Simulation can be as accurate as its data input.
- A simulation's result complexity is directly relevant with the complexity of the simulation itself.
- Simulation cannot solve problems by itself.

It is vital to realise that a poorly constructed methodology can yield bad results and vice versa. The methodology used is of equal importance for both correct data input and collection. It is therefore important to utilise the selection of each different data input point to exclude any errors to the actual analytical system due to them.

A researcher should not feel overconfident and relies just on results from FE analysis. Since FE analysis usually includes complicated mathematic formulas and complex algorithms the verification of developed models and obtained results should always be included into a study.

On the other hand the system should be formulated in a way to have a clear sight of the objectives without trying to oversimplify the input data and output results of complex problems. Although a very complex model can have a significant influence on the amount of a time for analysis, oversimplifying a model and missing

important elements of the analysis can have a detrimental effect on result accuracy. Thus, necessary to be completely aware regarding the analytical model's capabilities and limitations.

3.4 METHODS OF SEISMIC ANALYSIS

Selection of analysis method for seismic design depends on many factors such as the structure type and configuration, design goals and performance, seismic design category, and importance of the structure. In general, analysis methods could be divided into two main categories of static and dynamic analysis. On the other hand, both static and dynamic analysis can be performed as linear or nonlinear. Linear methods mentioned in Eurocode 8: Part 1 (2004) are as follows:

- Lateral force method of analysis may be applied to structures whose response is not significantly affected by contributions from modes of vibration higher than the fundamental mode in each principal direction.
- Modal response spectrum analysis which can be used for all structures whose response is/or can be significantly affected by contributions from modes of vibration higher than the fundamental mode in each principal direction.

Nonlinear methods mentioned in Eurocode 8: Part 1 (2004) are as follows:

- Non-linear static (pushover) analysis
- Nonlinear dynamic analysis (time history)

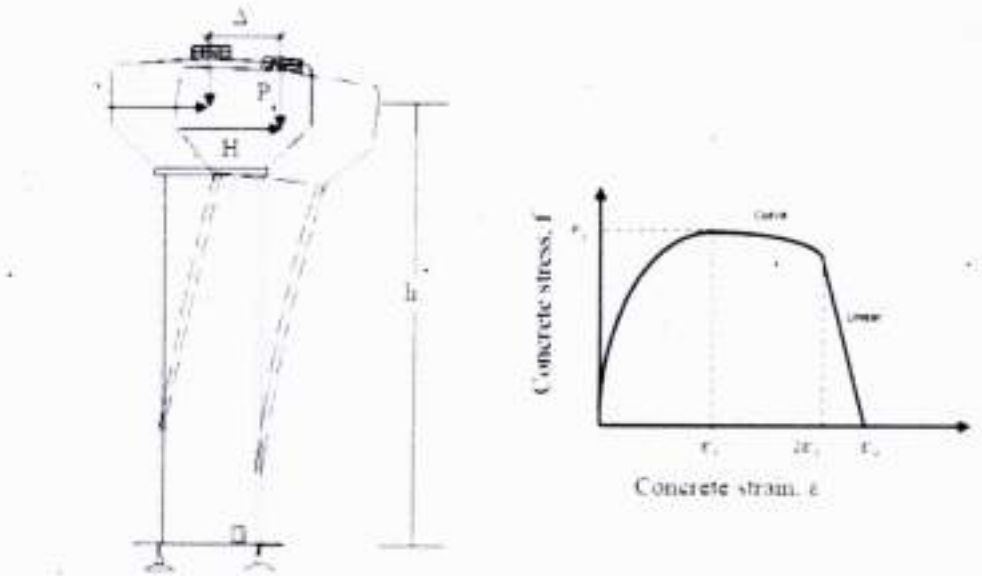
In general there two types of nonlinearities which can be observed in reinforced concrete structures that were considered for developing of FE models:

- geometric nonlinearity
- material nonlinearity

Geometric nonlinearity is the change in geometry where it significantly effects load deformation treatment in either the structure's elements (local) or the entire structure (global). Change in geometry could affect the analysis of the structure by changing the stiffness matrix hence change the equilibrium equation of the structure.

P-Δ effect is the most known geometric nonlinearity in structures. During severe earthquake loads elevated water tank experience large deformation at the top levels of concrete shaft combined with gravity load of the tank that resulted to global instability of the staging and failure of the entire structure could occur. Taller staging systems with large height to diameter ratio and larger tank capacities are more vulnerable to P-Δ effect (Fig 3.1(a)). Both P-Δ effect and large deformations were included in the FE nonlinear analyses.

On the other hand, material nonlinearity is associated with the inelastic behaviour of a component or system. Inelastic behaviour of materials was generated as a result of nonlinear stress-strain relationship and may be characterized by a force-deformation relationship. During a nonlinear static or dynamic analysis, stress level in shaft increases beyond the elastic limit of concrete and causes nonlinearity in stress-strain behaviour of materials as shown in Fig 3.1 (b).



(a) (b)

Fig 3.1. Type of nonlinearities: (a) geometric nonlinearity and (b) concrete nonlinearity

CHAPTER 4

PUSHOVER ANALYSIS

4.1 GENERAL

In case of structure deformation with yielding of structural elements, force-deformation relationship could not be determined using linear approaches, thus nonlinear analysis should be performed. One of the methods for obtaining inelastic relationship of a structure is the nonlinear static analysis, also known as a pushover analysis. Inelastic behaviour may be characterised by a force-deformation relationship, also known as a backbone curve, which measures strength against translational or rotational deformation. The pushover analysis is a simple way for determining a force-deformation nonlinear response for a structure subject to incrementally increasing lateral forces or displacements (Fig 4.2). The general force-deformation relationship shown in Fig 4.3. Figure showed that once a structure achieves its yielding strength nonlinear response took place until the structure reaches ultimate strength and finally degradation of strength leads formation of a failure mechanism and therefore collapse of the structure.

Pushover analysis was introduced in the early 1980s, however there were a number of modifications since that time. Originally, it was established as an analytical method for nonlinear analysis of structures for evaluating weak points and potential structural damages during seismic activity. Nowadays, pushover analysis is one of the most popular nonlinear analyses in seismic engineering suggested by many codes.

Pushover Analysis is that analysis which is carried out under permanent vertical loads and gradually increasing lateral loads to calculate the deformation as well as damage pattern of a structure. A plot of the total base shear versus top displacement in a structure is obtained by this analysis that would indicate any premature weakness. This plot is known as 'Capacity Curve'.

For developing modeling parameters, acceptance criteria (performance level) and procedures of pushover analysis, there are requirement of some documents such as The ATC-40(Applied Technology Council) and FEMA-356(Federal Emergency Management Agency) documents. These documents also describe the actions followed to determine the yielding of frame member during the analysis. Two actions are used to govern the inelastic behavior of the member during the pushover analysis that is deformation-controlled (ductile action) or force controlled (brittle action).

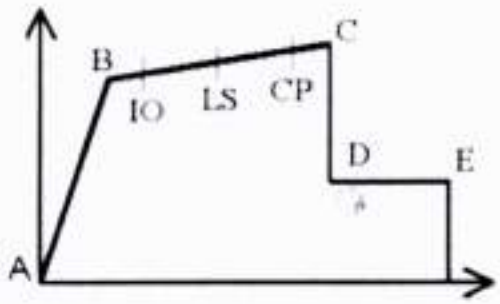


Fig 4.1 Force-Deformation Criterion for Hinges Used In Pushover Analysis

Acceptance Criteria (Performance Level)

The performance levels (IO, LS, and CP) of a structural element are represented in the load versus deformation curve as shown below,

B - Yield State

IO – immediate Occupancy

LS – Life Safety

CP – Collapse Prevention

C – Ultimate State

The nonlinear static analysis was documented as an acceptable method of analysis in Eurocode 8 (2004). The main advantage of the pushover analysis is avoiding the complexity of a time history analysis, however including important features of materials and geometry nonlinearities that are significant to seismic response.

The main purpose of conducting a pushover analysis is to establish the base shear versus roof displacement curve that could provide valuable information regarding seismic response properties of structures. Maximum developed base shear, ductility of the structure and maximum deformation prior to collapse are among the most useful information that might be derived from pushover curve. Additionally, pushover curve is a capacity curve for capacity spectrum analysis which combined with response spectrums provides an information of structure performance subjected to particular earthquake.

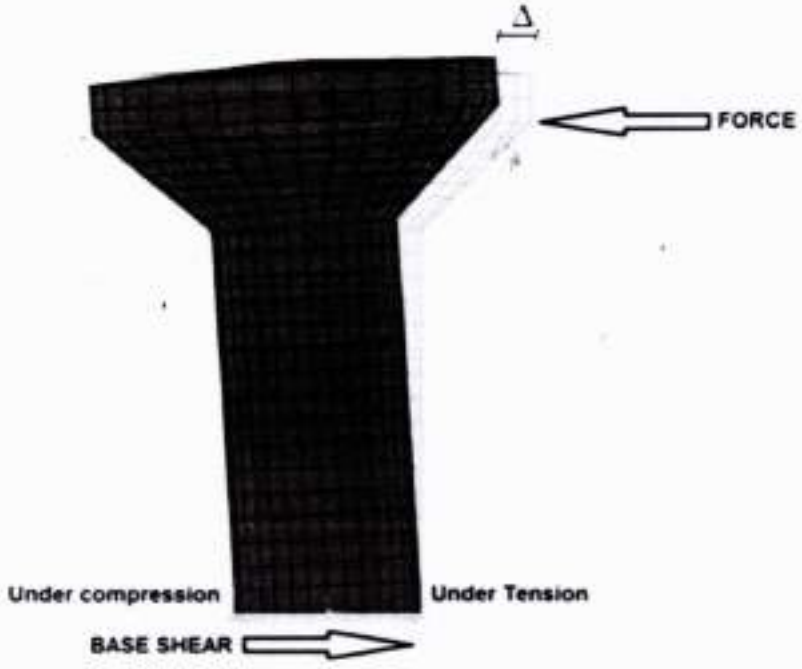


Fig 4.2 Typical RC elevated water tank subjected to pushover analysis

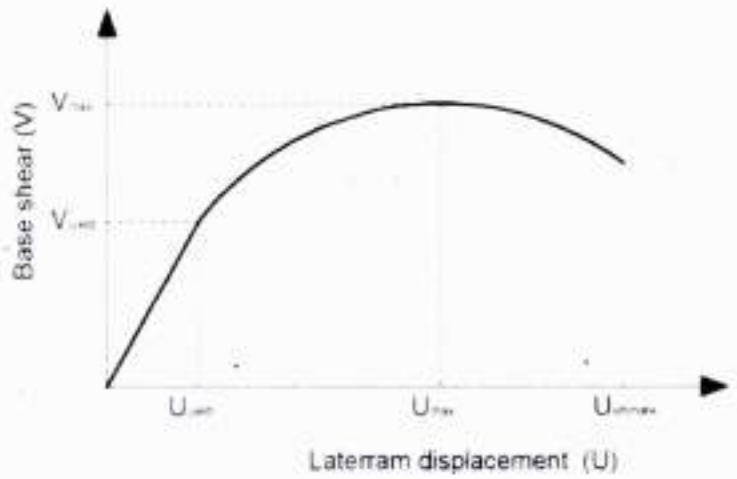


Fig 4.3 Typical pushover curve developed

4.2 TYPES OF PUSHOVER ANALYSIS

In general there are two main types of pushover analysis known as conventional pushover analysis and adaptive pushover analysis. In conventional pushover analysis, which recommended by Eurocode 8 (2004) lateral load is applied to the structure with a specific load pattern. The analysis continues until the lateral displacement of control node reaches to a specific value which is called target displacement or the structure collapses. In these methods, only the effect of dominant mode is considered and distribution of force or displacement remains constant during the analysis. On the other hand, in adaptive pushover analysis which considering higher modes effects the force pattern can be changed in different steps of analysis.

Selection of the proper method of pushover analysis highly depends on the configuration of the structures. In an extensive investigation, concluded that adaptive analysis demonstrates better performance comparing to conventional analysis for irregular and high-raised structures. However, there was not any significant differences in obtained results for symmetrical and middle-raised structures whose behaviour was dominated by first mode response.

An elevated water tank is a symmetrical structure which acts as an inverse pendulum and often more than 80% of the weight concentrates in the tank. Thus, in these structures usually more than 90% of the total mass participates in the fundamental mode. Because of the domination of the first mode in the behaviour of elevated water tanks conventional pushover analysis is assumed to be suitable for this study.

4.3 PROCEDURE OF PERFORMING PUSHOVER ANALYSIS

In order to perform a pushover analysis, initially the gravity load is applied to the mathematical model of structure. Next according to the defined force pattern, the model is subjected to an incremental lateral force. To get reliable results, the applied force pattern should be similar to the force produced during seismic excitations.

Consequently, the lateral load is increased until either the displacement at controlling point reaches a target displacement or the structure collapses. At each increment level, the base shear along with the corresponding displacement at the controlling point is recorded. Equation 4.1 shows the static equilibrium of the structure with small increments in linear region.

$$\Delta F = K \Delta U \qquad 4.1$$

Where:

ΔF is the incremental lateral load

K is the stiffness

ΔU is the incremental lateral displacement

Equation 4.1 can be rewritten by including the tangent stiffness matrix and accounting for nonlinear variation of both geometry and material in each load increment:

$$F = Kt \Delta U + Rt \qquad 4.2$$

Where:

Kt is the target stiffness matrix

Rt is the restoring forces at the beginning of each load increment

There are many numerical methods for solving the above equations from which the "Newton- Raphson" method was selected and employed in this research using FE software SAP2000. According to this method the load is divided into a number of load increments which can be applied during several load steps. In each step, after convergence of equations, the tangent stiffness matrix is revised and next load (or displacement) increment is applied. The increments continue until either the structure reaches to the target displacement or the integrations cease to converge.

The equation of equilibrium of a nonlinear static system subjected to a loading denoted by vector {F} is:

$$\{F\} = [K]\{U\} \quad 4.3$$

Where:

$[K]$ is the stiffness matrix

$\{U\}$ is the displacement vector

For one iteration, the equation of equilibrium can be written as:

$$[Ki]\{\Delta Ui\} = \{F\,a\} - \{Fi\,r\} \quad 4.4$$

$$\{Ui+1\} = \{Ui\} + \{\Delta Ui\} \quad 4.5$$

Where:

$[Ki\,T]$ is the tangent or Jacobian matrix;

$\{Fi\,r\}$ is the restoring load;

i is the index indicating the current iteration vector.

The following algorithm should be employed until the convergence is achieved:

1. Initial state: assume $U0$, at the beginning $U0$ is usually $\{0\}$
2. Calculation for each iteration:

- Calculate Jacobian matrix $[Ki\,T]$ and restoring vector $\{Fi\,r\}$ for the current step
- Calculate ΔUi

- Substitute ΔUi in Equation 3.10 and find $\Delta Ui+1$ 3.

3. Repeat step 2 until the convergence is attained.

4.4 CAPACITY SPECTRUM ANALYSIS

In this study elevated water tanks were analysed using capacity spectrum method suggested by N2 (Eurocode 8: Part 1, 2004) and ATC-40 (ATC, 2010). Capacity spectrum method is simple nonlinear method used for calculation of structures subjected to seismic loads. Capacity spectrum method can be considered as combination of pushover analysis and response spectrum analysis. Inelastic demanded spectrum is obtained from elastic spectrum. The accuracy of the method is satisfactory if the structure had dominant first mode of oscillation, such as elevated water tank.

The capacity spectrum method requires that both the capacity curve (pushover curve) and the demand curve (response spectrum) are represented in response spectral ordinates. It characterises the seismic demand initially using a 5% damped linear-elastic response spectrum and reduces the spectrum to reflect the effects of energy dissipation to estimate the inelastic displacement demand. The point at which the capacity curve intersects the reduced demand curve represents the performance point at which capacity and demand are equal. Evaluation of performance point shown in Fig4.4. The location of this performance point relative to the performance levels defined by the capacity curve indicates whether or not the performance objective is met.

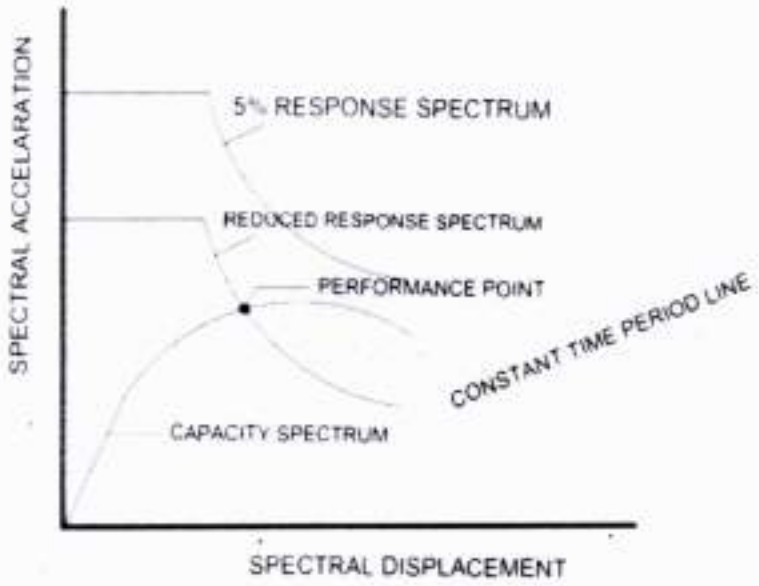


Fig 4.4 Evaluation of a performance point

The employment of the non-linear static procedure involves four distinct phases as described below .

- Define the mathematical model with the non-linear force deformation relationships for the various components/elements.
- Define a suitable lateral load pattern and use the same pattern to define the capacity of the structure.
- Define the seismic demand in the form of an elastic response spectrum.
- Evaluate the performance of the structure.

CHAPTER 5

MODELLING

5.1 PROCEDURE

- Create three dimensional model of tank.
- Implementation and application of gravity loads, live loads, and water load, etc.
- Define properties and acceptance criteria for the pushover hinges.The program includes several built-in default hinge properties that are based on average values from ATC-40 for concrete members and average values from FEMA-356 for steel members.
- Locate the pushover hinges on the model by selecting one or more frame members and assigning them one or more hinge properties.
- Define the pushover load cases.
- Push the structure using the load patterns of static lateral loads, to displacements larger than those associated with target displacement using static pushover analysis.
- The numbers of hinges are shown in the Fig 5.1 in each member showing the hinges in columns the immediate occupancy, life safety, collapse prevention to define the force deflection behavior of the hinge.
- The lateral load is applied on the frame, which when deflected forms hinges. The plastic hinge formation at the yielding and significant difference in the hinging patterns at the ultimate state.
- Developing a pushover curve and estimating the force and deformations in each element at the level of displacement corresponding to target displacement.
- The node associated at centre of gravity (CG) of container is the target point/node selected for comparison with target displacement. The maximum limit for roof displacement is given as 0.004H, where H is the height of the

structure. Base shear and roof displacements are recorded at every step, to obtain the pushover curve.

5.2 SPECIFICATION

SL.NO	PARAMETERS	DIMENSION
1	Capacity	500 m^3
2	Height of columns	15m
3	Thickness of roof slab	200mm
4	Thickness of wall	300mm
5	Thickness of floor slab	450mm
6	Floor beam	400*300mm
7	Braces	400*300mm
8	Top ring	600*300mm
9	Column	600*600mm
10	No of column	8,10,12
11	Type of bracing	Normal, Cross, Hexagonal
12	Material	M30 Grade Concrete & Fe415

Fig 5.1 Model shape of water tank

5.3 STRUCTURAL MODELING 3D VIEW OF TANKS

Fig 5.2 8 Number of Columns Normal Staging

Fig 5.3 8 Number of Columns Cross Staging

Fig 5.4 8 Number of Columns Hexagonal Staging

Fig 5.5 10 Number of Columns Normal Staging

Fig 5.6 10 Number of Columns Cross Staging

Fig 5.7 10 Number of Columns Hexagonal Staging

Fig 5.7 12 Number of Columns
Normal Staging

Fig 5.8 12 Number of Columns
Cross Staging

Fig 5.9 12 Number of Columns
Hexagonal Staging

CHAPTER 6

ANALYSIS AND RESULTS

6.1 Base Shear

Using normal, cross and hexagonal staging arrangements with eight, ten and twelve number of columns and h/d ratio 0.5, 0.6, 0.7 following base shear values were drawn.

Table 6.1 Values of Base Shear

SL.No	h/d Ratio	No of Columns	Types of Staging Arrangement	Base Shear (Empty Tank) (kN)	Base Shear (Full Tank) (kN)
1	0.5	8	Normal	247.720	571.850
2			Cross	299.930	629.984
3			Hexagonal	307.880	637.930
4		10	Normal	257.053	588.470
5			Cross	296.460	627.879
6			Hexagonal	308.299	639.720
7		12	Normal	265.605	595.605
8			Cross	315.512	647.670
9			Hexagonal	320.410	652.567
10	0.6	8	Normal	243.295	566.792
11			Cross	286.580	610.178
12			Hexagonal	292.215	617.622
13		10	Normal	250.376	575.210
14			Cross	289.990	615.828
15			Hexagonal	302.123	628.028
16		12	Normal	246.060	581.620
17			Cross	302.796	623.581

SL.No	h/d Ratio	No of Columns	Types of Staging Arrangement	Base Shear (Empty Tank) (kN)	Base Shear (Full Tank) (kN)
18	0.6	12	Hexagonal	307.458	634.041
19	0.7	8	Normal	238.25	561.983
20			Cross	279.55	603.284
21			Hexagonal	277.281	601.010
22		10	Normal	245.292	570.363
23			Cross	283.955	609.026
24			Hexagonal	293.158	618.229
25		12	Normal	251.006	576.806
26			Cross	290.846	620.607
27			Hexagonal	300.902	626.702

6.2 Displacement

Using normal, cross and hexagonal staging arrangements with eight, ten and twelve number of columns and h/d ratio 0.5, 0.6, 0.7 following displacement values were drawn.

Table 6.2 Values of Displacement

SL.No	h/d Ratio	No of Columns	Types of Staging Arrangement	Displacement (Empty Tank) (mm)	Displacement (Full Tank) (mm)
1	0.5	8	Normal	52.188	130.021
2			Cross	47.534	116.441
3			Hexagonal	47.235	124.944
4		10	Normal	43.868	121.813
5			Cross	39.504	97.343
6			Hexagonal	38.857	94.799
7		12	Normal	37.968	105.771
8			Cross	35.685	85.357
9			Hexagonal	33.993	82.080
10	0.6	8	Normal	51.465	141.880
11			Cross	45.847	123.029
12			Hexagonal	45.678	111.694
13		10	Normal	42.805	109.210
14			Cross	38.737	106.812
15			Hexagonal	38.177	102.614
16		12	Normal	36.763	93.439
17			Cross	32.667	79.797
18			Hexagonal	33.005	79.790
10	0.7	8	Normal	50.646	130.625
20			Cross	45.322	112.066

SL.No	h/d Ratio	No of Columns	Types of Staging Arrangement	Displacement (Empty Tank) (mm)	Displacement (Full Tank) (mm)
21	0.7	8	Hexagonal	43.455	109.299
22		10	Normal	42.143	118.097
23			Cross	38.203	100.313
24			Hexagonal	37.566	98.922
25		12	Normal	36.290	92.628
26			Cross	31.339	88.726
27			Hexagonal	32.605	79.307

6.3 Axial Force

Using normal, cross and hexagonal staging arrangements with eight, ten and twelve number of columns and h/d ratio 0.5, 0.6, 0.7 following axial force values were drawn.

Table 6.3 Values of Axial Force

SL.No	h/d Ratio	No of Columns	Types of Staging Arrangement	Axial Force (Empty Tank) (kN)	Axial Force (Full Tank) (kN)
1	0.5	8	Normal	789.070	1816.658
2			Cross	885.492	1907.213
3			Hexagonal	913.624	1941.144
4		10	Normal	633.845	1452.464
5			Cross	711.636	1538.170
6			Hexagonal	747.706	1593.945
7		12	Normal	549.469	1241.900
8			Cross	621.144	1295.123
9			Hexagonal	638.368	1339.733
10	0.6	8	Normal	773.890	1790.467
11			Cross	870.549	1821.661
12			Hexagonal	897.639	1925.192
13		10	Normal	614.102	1439.282
14			Cross	709.926	1554.798
15			Hexagonal	715.996	1516.628
16		12	Normal	541.311	1046.561
17			Cross	605.378	1254.306
18			Hexagonal	621.318	1260.510
19	0.7	8	Normal	777.453	1811.362
20			Cross	870.854	1908.164
21			Hexagonal	872.847	1927.466

SL.No	h/d Ratio	No of Columns	Types of Staging Arrangement	Axial Force (Empty Tank) (kN)	Axial Force (Full Tank) (kN)
22	0.7	10	Noraml	630.500	1454.683
23			Cross	693.089	1428.566
24			Hexagonal	715.339	1536.145
25		12	Normal	544.128	1245.027
26			Cross	607.871	1328.436
27			Hexagonal	626.761	1334.746

6.4 Moment

Using normal, cross and hexagonal staging arrangements with eight, ten and twelve number of columns and h/d ratio 0.5, 0.6, 0.7 following moment values were drawn.

Table 6.4 Values of Moment

SL.No	h/d Ratio	No of Columns	Types of Staging Arrangement	Moment (Empty Tank) (kNmm)	Moment (Full Tank) (kNmm)
1	0.5	8	Normal	19.566	47.743
2			Cross	14.800	27.285
3			Hexagonal	15.449	26.376
4		10	Normal	20.900	47.443
5			Cross	18.046	33.860
6			Hexagonal	18.502	33.853
7		12	Normal	19.513	38.460
8			Cross	16.885	29.804
9			Hexagonal	17.898	31.497
10	0.6	8	Normal	19.433	46.925
11			Cross	14.402	24.990
12			Hexagonal	15.010	24.126
13		10	Normal	18.543	44.299
14			Cross	15.587	29.709
15			Hexagonal	16.085	26.869
16		12	Normal	18.648	36.658
17			Cross	15.644	26.987
18			Hexagonal	16.792	27.840
19	0.7	8	Normal	18.636	45.624
20			Cross	14.739	23.645
21			Hexagonal	15.173	24.124
22		10	Normal	18.229	43.053

SL.No	h/d Ratio	No of Columns	Types of Staging Arrangement	Moment (Empty Tank) (kNmm)	Moment (Full Tank) (kNmm)
	0.7	10	Cross	15.468	28.120
			Hexagonal	16.455	28.033
25		12	Normal	18.310	35.854
26			Cross	16.058	27.362
27			Hexagonal	16.531	28.303

6.5 PUSHOVER CURVE

The pushover curve represents the non- linear behavior of the structure and is a load deformation curve of the base shear force versus the horizontal roof displacement of the structure.

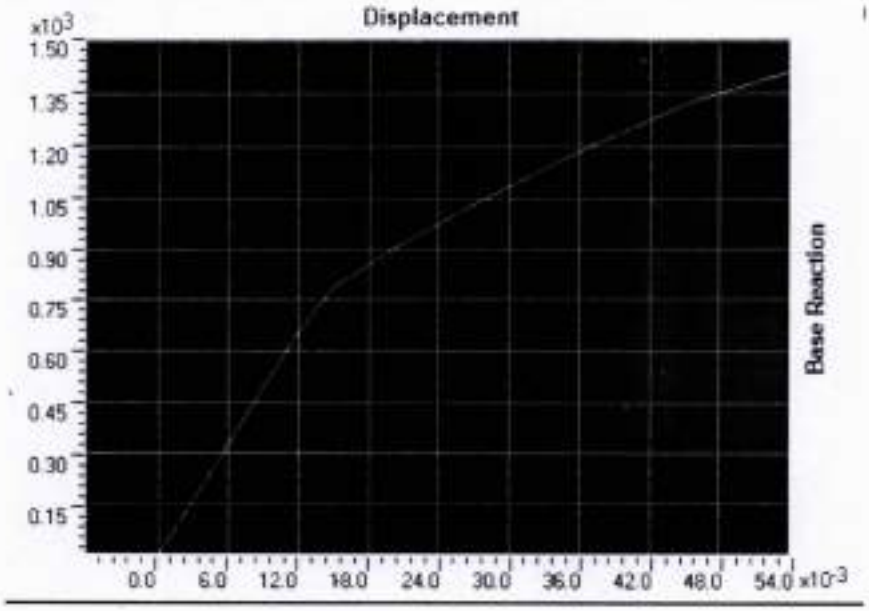


Fig 6.1 Pushover curve- 8 No of Columns,Normal Staging

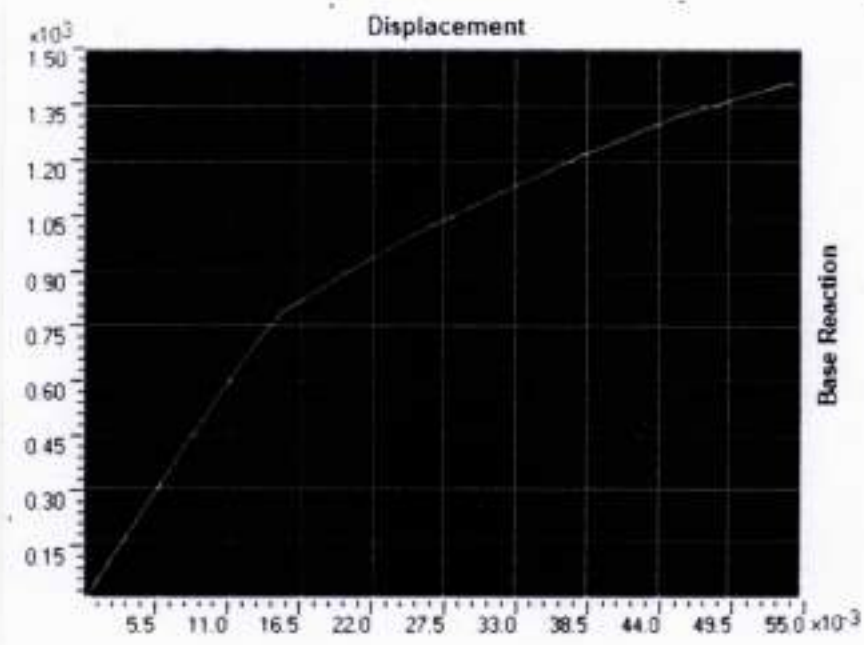


Fig 6.2 Pushover curve- 8 No of Columns,Cross Staging

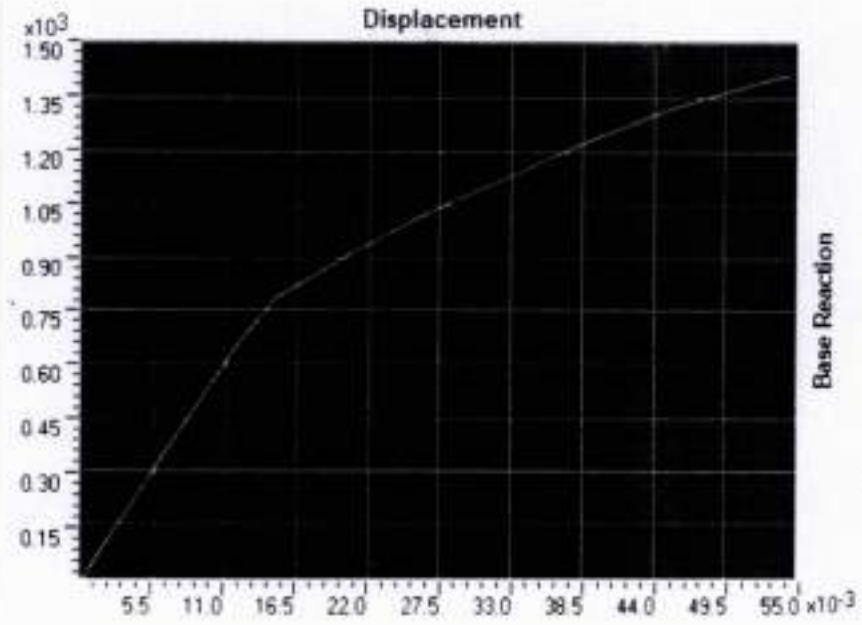


Fig 6.3 Pushover curve- 8 No of Columns,Hexagonal Staging

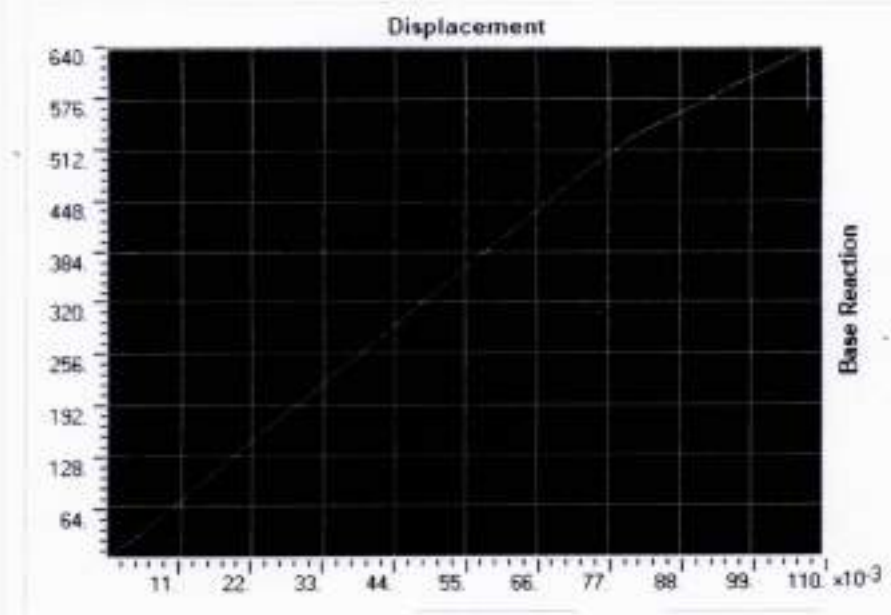


Fig 6.4 Pushover curve- 10 No of Columns,Normal Staging

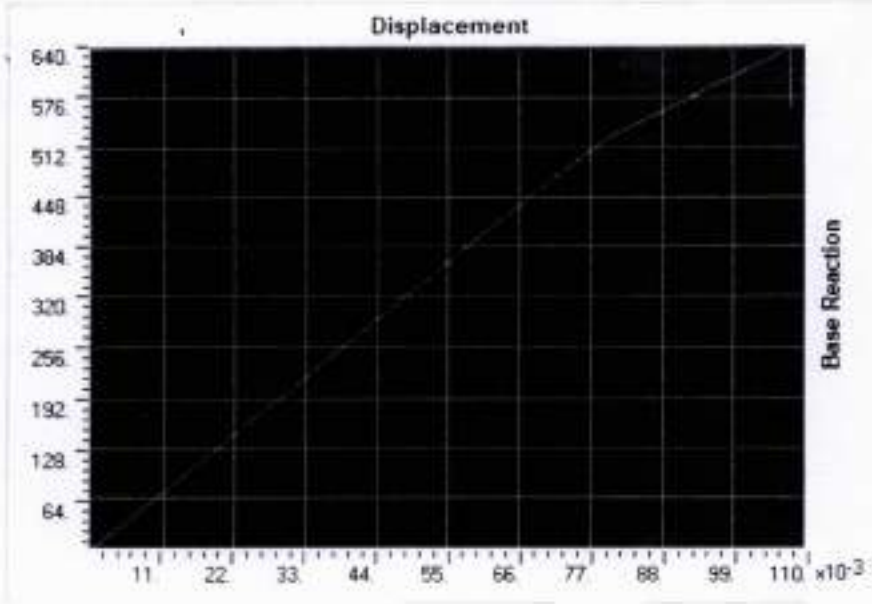


Fig 6.5 Pushover curve- 10 No of Columns,Cross Staging

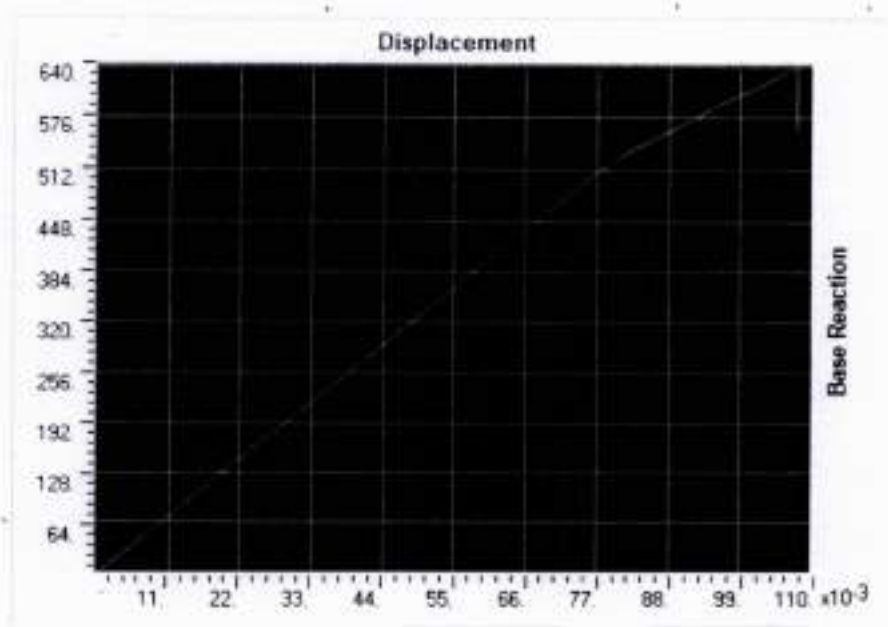


Fig 6.6 Pushover curve- 10 No of Columns,Hexagonal Staging

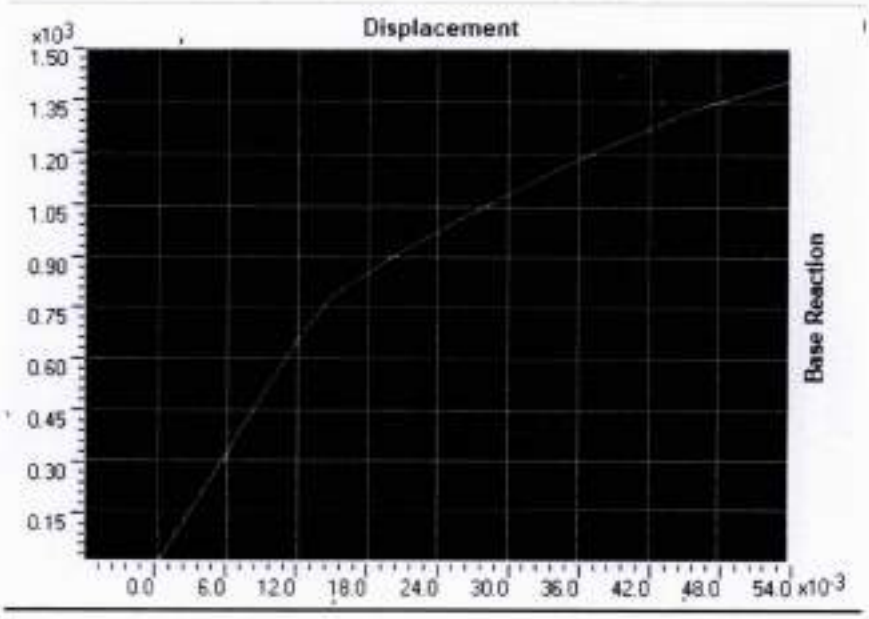


Fig 6.7 Pushover curve- 12 No of Columns,Normal Staging

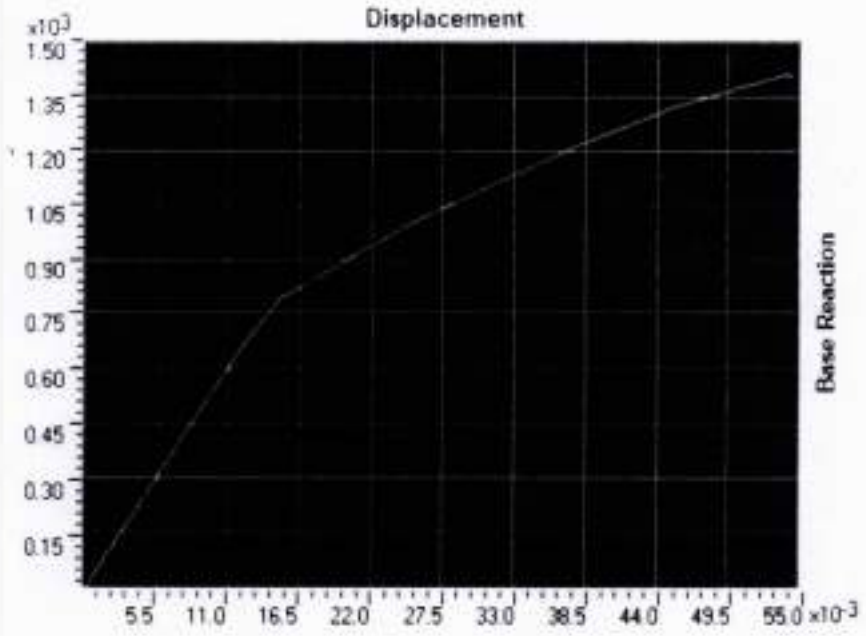


Fig 6.8 Pushover curve- 12 No of Columns,Cross Staging

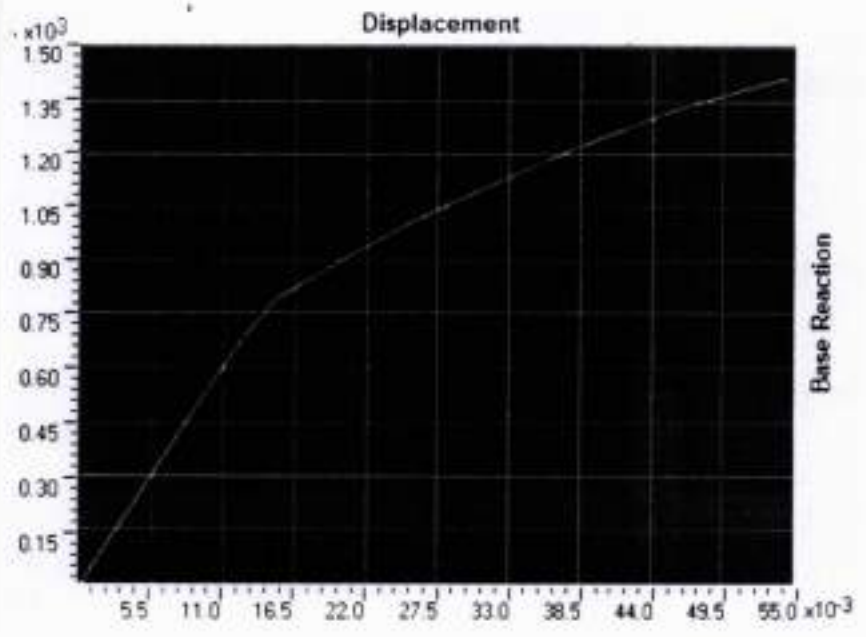


Fig 6.9 Pushover curve- 12 No of Columns,Hexagonal Staging

CHAPTER 7

CONCLUSIONS

Using normal, cross and hexagonal staging arrangements with eight, ten and twelve number of columns and h/d ratio 0.5, 0.6, 0.7 following conclusions were drawn.

1. Displacement

- The minimum displacement for twelve no. of columns with hexagonal staging type was observed in the model with h/d ratio 0.5.
- The minimum displacement for twelve no. of columns with cross staging type was observed in the model with h/d ratio 0.6.
- The minimum displacement for twelve no. of columns with cross staging type was observed in the model with h/d ratio 0.7

2. Axial Force

- The minimum axial force for Ten no. of columns with normal staging type was observed in the model with h/d ratio 0.5, 0.6 and 0.7.

3. Moment

- The minimum Moment for Ten no. of column with cross staging type was observed in the model with h/d ratio 0.5
- The minimum Moment for Eight no. of column with cross staging type was observed in the model with h/d ratio 0.6.
- The minimum Moment for Eight no. of column with cross staging type was observed in the model with h/d ratio 0.7

4. For full tank and empty condition as the numbers of columns increases, base shear increases.
5. Base Shear is more for h/d ratio 0.5 normal staging type as compared to other h/d ratio and value of base shear is more for tank full condition than tank empty condition.

6. Deflection was found to be less than with h/d ratio 0.7 hexagonal staging type for 8, 10 and 12 No of Columns as compared to other h/d ratio.
7. It concludes that for 0.7 h/d ratio cross staging type gives best performance for Displacement, Axial Force and Moment.

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(Affiliated to APJ Abdul Kalam Technological University and Approved by AICTE New Delhi)

MINI PROJECT

REPORT ON

HEART RATE MONITOR

Submitted in partial fulfillment of the requirement for the award of the degree of

Bachelor of Technology

Presented by

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SOORAJ SURESH V O (SNC20EC005)

THEJASREE T K (SNC20EC006)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

2023

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(Affiliated to APJ Abdul Kalam Technological University and Approved by AICTE New Delhi)

DEPARTMENT OF ELECTRONICS AND COMMUNICATION ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that the project entitled "**HEART RATE MONITOR**" is a bonafide record of the work done by **THEJASREE T K** of SIXTH Semester **Electronics and Communication Engineering** towards the partial fulfilment for the award of degree of Bachelor of Technology by APJ Abdul Kalam Technological University.

Mini project coordinator

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ABSTRACT

Heart rate, body temperature and blood pressure monitoring are very important parameters of human body. Doctors use various kinds of medical apparatus like thermometer for checking fever or body,temperature, BP monitor for blood pressure measurement and heart rate monitor for heart rate measurement. In this project, we look forward in building a heartbeat monitor which counts the number of heartbeats within a desired time. Using a heartbeat sensor module which senses the heartbeat upon putting a finger on the sensor to make a Smart Health Monitoring Device that can measure SpO2× (percentage of oxygen in the blood) and heart rate in BPM (Beat per Minute).

CONTENT

LIST OF FIGURES

CHAPTER 3

INTRODUCTION

Over the last 20 years, heart rate monitors (HRMs) have become a widely used training aid for a variety of sports. The development of new HRMs has also evolved rapidly during the last two decades. In addition to heart rate (HR) responses to exercise, research has recently focused more on heart rate variability (HRV). Increased HRV has been associated with lower mortality rate and is affected by both age and sex. During graded exercise, the majority of studies show that HRV decreases progressively up to moderate intensities, after which it stabilizes. There is abundant evidence from cross-sectional studies that trained individuals have higher HRV than untrained individuals. Heart rate data can be really useful whether you're designing an exercise routine, studying your activity or anxiety levels or just want your shirt to blink with your heart beat.

Monitoring heart rate is very important for athletes, patients as it determines the condition of the heart (just heart rate). There are many ways to measure heart rate and the most precise one is using an Electrocardiography. Heart rate is the number of heart heats per unit of time, typically expressed as beats per minute (bpm)

Heart rate can vary as the body's need to absorb oxygen and excrete C02 changes, such as during exercise or sleep. The measurement of heart rate is used by medical professionals to assist in the diagnosis and tracking of medical conditions. It is also used by individual, such as athletes, who are interested in monitoring their heart rate to gain maximum efficiency from their training.

CHAPTER 2
LITERATURE REVIEW

The five methods taken into consideration for the literature review of our project are discussed below.

This paper describes the working of a wireless heartbeat and temperature monitoring system based on a microcontroller ATmega328 (arduino uno). Most monitoring systems that are in use in today's world works in offline mode but our system is designed such that a patient can be monitored remotely in real time. The proposed approach consists of sensors which measures heartbeat and body temperature of a patient which is controlled by the microcontroller. Both the readings are displayed in LCD monitor. Wireless system is used to transmit the measured data from the remote location. The heartbeat sensor counts the heartbeat for specific interval of time and estimates Beats per Minute while the temperature sensor measures the temperature and both the data are sent to the microcontroller for transmission to receiving end. Finally, the data are displayed at the receiving end. This system could be made available at a reasonable cost with great effect.

Nowadays, most electronic devices are wireless, and most industrial sectors also have already adopted industrial 4.0. This Arduino and NodeMCU ESP8266 Heart Rate Monitoring Robot helps to continually observe users remotely. People remain at home, avoid others, and change routine activities such as school and work in ways never imagined. The aim is to reduce direct human contact. This project will use a robot to automatically monitor the heart rate of patients at a hospital or clinic. The heart rate measuring code is written in Arduino IDE and uploaded to the Arduino UNO and NodeMCU ESP 8266 boards. The data will be transferred to the cloud for doctor monitoring.

Detection of any disease of any patient is the only main solution with the help of electronics devices patient can check our heart rate and oxygen level reading. If any problem has not human being, then lifestyle has also increased. But if people have any type disease occurred in body then first doctor test and then start the treatment. If people will have any that type of electronics checking device then doctor will not be need to checking the human body problem, then doctor can directly start the treatment basis of device reading. So cardiovascular disease is very dangerous type disease for human being by this human being can be died within second. This main problem is solved by doctor by treatment if patient reach on time. This work gives a proper system, with the help of that system patient can control our disease by himself that means there is no need of paying extra money for checking heart beat and oxygen level because all reading will have then his treatment directly started no time loss for treatment This research aim is that gives that type idea of idea for designing a device which is useful for normal human. If any device cost is very low and gives an efficient result, then any person can take benefit. It design is different other type device, in which Node MCU technology and LCD display and a latest sensor max30100 is used. It will be display on LCD screen, alert by a message which will be sent through mobile phone to the doctor and oxygen level will also display on screen

This paper describes the design process of a low cost and portable microcontroller based heart-rate counting system for monitoring heart condition that can be implemented with off-the-shelf components. The raw heart-rate signals were collected from finger using IR TX-RX (Infrared Transmitter and Receiver pair) module which was amplified in order to convert them to an observable scale. Extending the concept, we have replaced Arduino board with NODE MCU. In this extension we have used Thing Speak and created a private channel. In that channel updating of heart rate at regular intervals is done. If it crosses a particular limit or threshold limit it will be send to a concern doctor. This technique can be used in remote areas. The results obtained using the developed device when compared to those obtained from the manual test involving counting of heart rate was found satisfactory. The proposed system is applicable for family, hospital, clinic, community medical treatment, sports healthcare and other medical purposes

Recently, the world has been hit by COVID-19 pandemic. Nearly about every country has been devastated as they lack a proper health infrastructure. India is one such country where overpopulation is the key reason not everyone has access to medical facilities and are therefore forced to home quarantine. IoT is an ingenious technology which opens a new digitized path in terms of data storage and processing in today's medical world to provide the healthcare systems with the best networking techniques. In this present paper, the authors have created a framework of body temperature, oxygen saturation level (SpO2), BPM (heart rate) and air quality sensors based innovative smart disease surveillance system with amalgamation of nodeMCU. The obtained output is displayed on the LCD display and additionally with the aid of IoT-cloud based app (blynk) the doctor can monitor real time health data. Also, a key feature named Report generates and sends the readings in CSV/Excel format. The health parameters of the proposed prototype have a maximum deviation of 1%, is cost-effective, portable, reliable and high functionality as compared to the commercially available one.

CHAPTER 3

BLOCK DIAGRAM & EXPLANATION

3.1 BLOCK DIAGRAM

The block diagram of a Heart rate monitor using NodeMcu is shown:

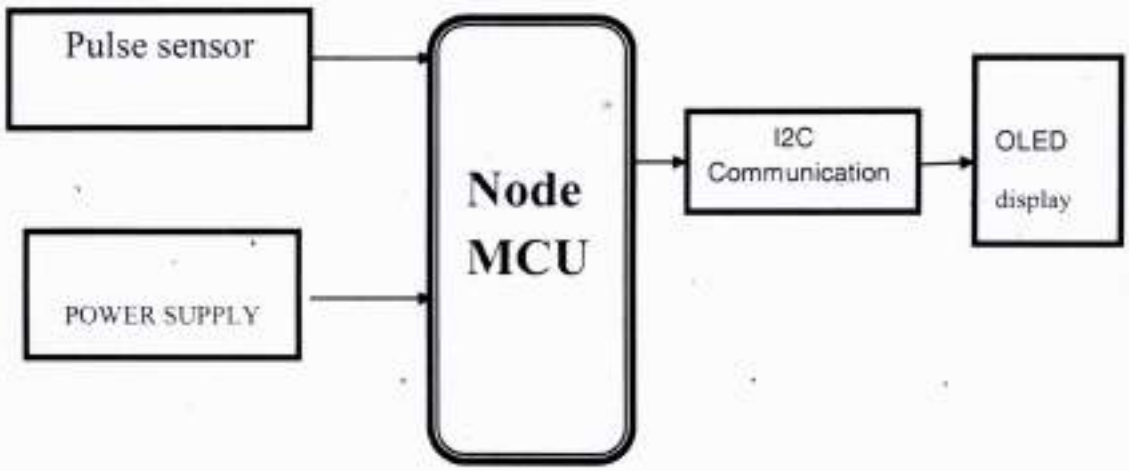


Fig 3.1 Block Diagram

3.2 BLOCK DIAGRAM EXPLANATION

The principle behind the working of the Heartbeat Sensor is Photoplethysmography. According to this principle, the change in the volume of blood in an organ is measured by the changes in the intensity of the light passing through that organ. With these two i.e. a light source and a detector, we can arrange them in two ways: A Transmission Sensor and a Reflective Sensor. In a Transmission Sensor, the light source and the detector are place facing each other and the finger of the person must be placed in between the transmitter and receiver. Reflective Sensor, on the other hand, has the light source and the detector adjacent to each other and the finger of the person must be placed in front of the sensors.The input for this circuit is taken from fingertip whenever the finger is placed on the pulse sensor it calculates the heart rate based on amount of blood flowing display it in OLED display.

CHAPTER 4

COMPONENTS

4.1 MAX30100 Pulse Oximeter

The MAX30100 pulse oximetry & heart- rate monitor sensor is a low-power, I2C-basedplug & play biometric sensor for detecting pulse oximetry & heart-rate signals. This sensor includes two LEDs like RED & IR LED, a photodetector, modifiable optics & low noise signal processor to detect heart pulse rate signals. On the right side of this sensor, two LEDs are available whereas on the left side, it has a sensitive photodetector. This sensor is used in various medical & industrial equipment like fitness measurement devices, wearable instruments & medical devices.

Fig 4.1 MAX30100 Pulse Oximeter

This sensor module configuration can be done through software registers & this module's output data is simply stored within 16 FIFOs on this module. This pulse oximeter sensor communicates with different microcontrollers through the I2C interface. In this sensor module, the pulse measurement system includes a 16-bit ADC, a time filter & cancellation of ambient light.

Working of MAX30100 Pulse Oximeter and Heart-Rate Sensor

The device has two LEDs, one emitting red light, another emitting infrared× light. For pulse rate, only the infrared light is needed. Both the red light and infrared light is used to measure oxygen levels in the blood. When the heart pumps blood, there is an increase in oxygenated blood as×a result of having more blood. As the heart relaxes, the volume of oxygenated blood also decreases. By knowing the time between the increase and decrease of oxygenated blood, the pulse rate is determined. It turns out, oxygenated blood absorbs more infrared light and passes more× red light while deoxygenated blood absorbs red light and passes more infrared light. This is the main function of the MAX30100: it reads the absorption levels for both light sources and stored them in a buffer that can be read via I2C.

Pin Configuration:

The pin configuration of the MAX30100 pulse oximeter sensor is shown below. This sensor includes pins and each pin is discussed below.

Pin1 (VIN): This pin provides a power supply to the sensor.

Pin2 (SCL): This pin is the I2C serial CLK pin.

Pin3 (SDA): This pin is the I2C serial data pin.

Pin4 (INT): This is an interrupt pin that is pulled HIGH through the onboard resistor although when an interrupt takes place, it goes LOW until it clears.

Pin5 (IRD): It is an infrared LED cathode & also a connection point of the LED Driver.

Pin6 (RD): It is a Red LED cathode & connection point of the LED driver.

Pin7 (GND): This is a ground pin and it is connected to the source GND pin.

4.2 NodeMCU ESP8266

ESP8266 Wi-Fi SoC is embedded with the memory controller, including SRAM and ROM. Node Microcontroller Unit is named as NodeMCU which is open source× software and firmware that is built around System- on-Chip (SoC) called the ESP8266. The ESP8266 is designed and manufactured by Express. It contains the crucial elements like CPU, RAM, networking (Wi-Fi) NodeMCU is an open source platform for IOT development. It includes firmware which is necessary to run ESP8266 and hardware which are based on ESP-12 module. Some of its advantages relative to Arduino are low cost, reduced physical size, lower energy consumption and integrated support for Wi-Fi networks. Both its firmware and prototyping board designs are open source. The Lua scripting language is used for scripting. It is also programmed using an Arduino IDE. NodeMCU is the brain of our system, all the sensors are connected to the nodeMCU and the data received from various sensors are computed, analysed, display the SpO2 and BPM on LCD and then send all the data to the cloud. So authorized person i.e. doctor could read the vitals readings.

Fig 4.2 NodeMCU ESP8266

4.3 ORGANIC LEDs

'OLED' stands for Organic Light-Emitting Diode - a technology that uses LEDs in which the light is produced by organic molecules. OLED displays feature great image quality - bright colors, fast motion and most importantly - very high contrast. OLED displays are made by placing a series of organic thin films between× two conductors. When an electrical current is applied, a bright light is emitted. OLED displays are made by placing a series of organic thin films between two conductors.

Fig 4.3 OLED Display

When an electrical current is applied, a bright light is emitted OLED display is a small, low-power display that uses the I2C protocol to communicate with a microcontroller board. the I2C interface requires only two data lines (SDA and SCL) to transfer data.OLED (Organic Light Emitting Diode) technology allows the display to emit light without a backlight, resulting in deeper blacks and higher contrast ratios than traditional LCD displays.

Interfacing MAX30100 Pulse Oximeter with NodeMCU ESP8266 and I2C 0.96" OLED Display.

Both the MAX30100 & OLED Display has common I2C Pins. So connect their SDA pins to D2 & SCL pins to D1 of NodeMCU ESP8266 Board. The power supply required by OLED Display & NodeMCU is 3.3V. So connect their VCC terminal to 3.3V of NodeMCU.

CHAPTER 5

CIRCUIT DIAGRAM & EXPLANATION

5.1 CIRCUIT DIAGRAM

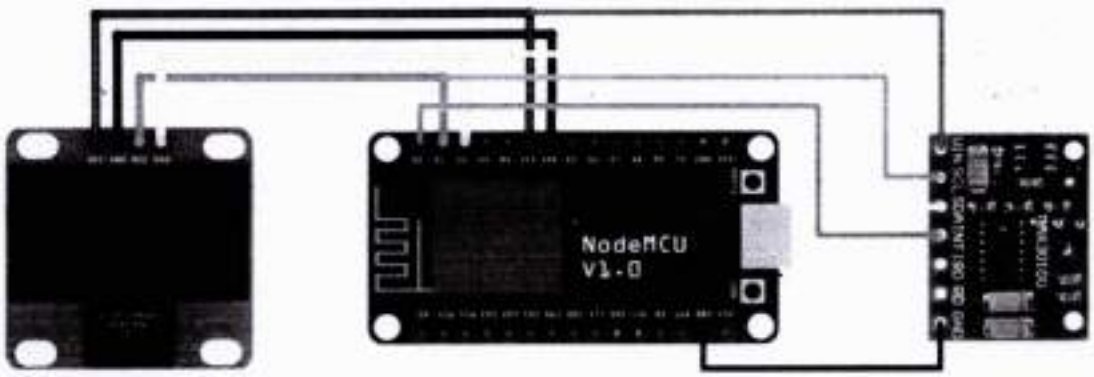


Fig 5.1: Circuit Diagram

5.2 CIRCUIT DIAGRAM EXPLANATION

The circuit diagram consists of 2 Parts – NODE MCU and PULSE SENSOR Upload the code to NodeMCU and Power on the system. The NodeMCU asks us to place our finger in the sensor and press the switch. Place any finger (except the Thumb) in the sensor clip and push the switch (button). Based on the data from the sensor, NodeMCU calculates the heart rate and displays the heartbeat in bpm. While the sensor is collecting the data, sit down and relax and do not shake the wire as it might result in a faulty values. After the result is displayed on the OLED display, if you want to perform another test, just push the rest button on the circuit board and start the procedure once again. Connections is as follows NodeMCU 3.3v is connected to positive terminal of the pulse sensor and ground of the NodeMCU is connected to negative terminal of pulse sensor.

CHAPTER 6

SOFTWARE SECTION

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino hardware to upload programs and communicate with them.

The Arduino IDE is an open-source software, which is used to write and upload code to the Arduino boards. The IDE application is suitable for different operating systems such as Windows, Mac OS X, and Linux. It supports the programming languages C and C++. Here, IDE stands for Integrated Development Environment. The program or code written in the Arduino IDE is often called as sketching. We need to connect the Genuino and Arduino board with the IDE to upload the sketch written in the Arduino IDE software. The sketch is saved with the extension '.ino.'

Programs written using Arduino Software (IDE) are called sketches. These sketches are written in the text editor and are saved with the file extension. ino. The editor has features for cutting/pasting and for searching/replacing text. The message area gives feedback while saving and exporting and also displays errors. The console displays text output by the Arduino Software (IDE), including complete error messages and other information. The bottom right hand corner of the window displays the configured board and serial port. The toolbar buttons allow you to verify and upload programs, create, open, and save sketches, and open the serial monitor.

6.1 FLOWCHART

6. 1 (a) Hardware Section Flowchart

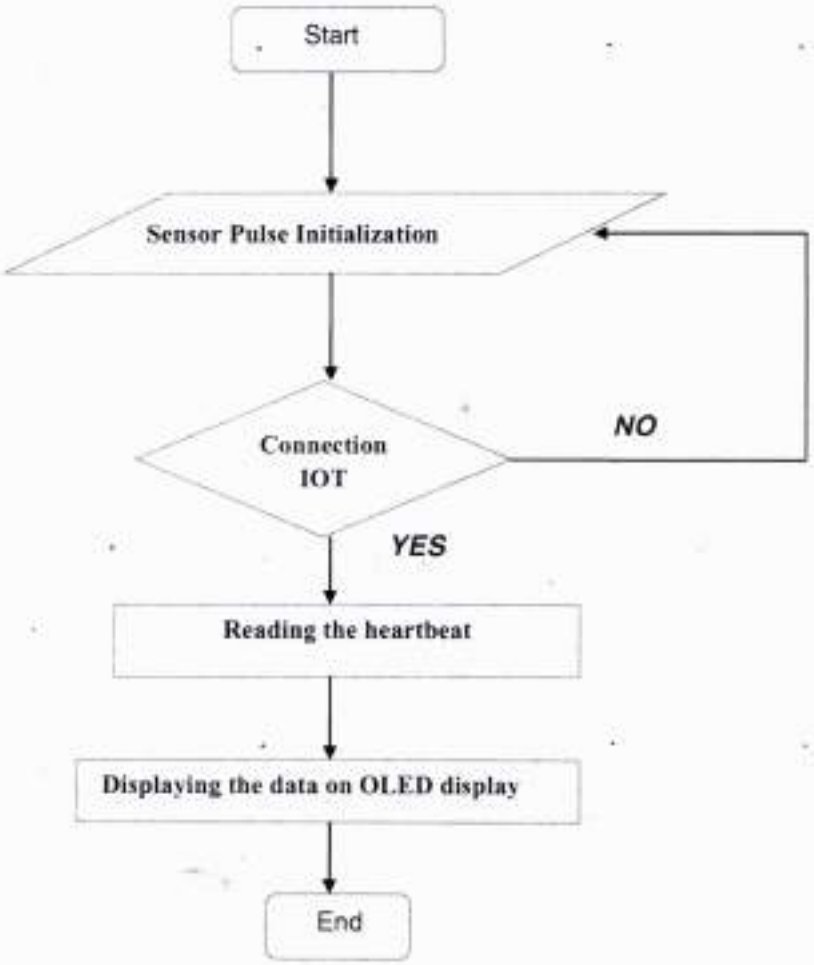
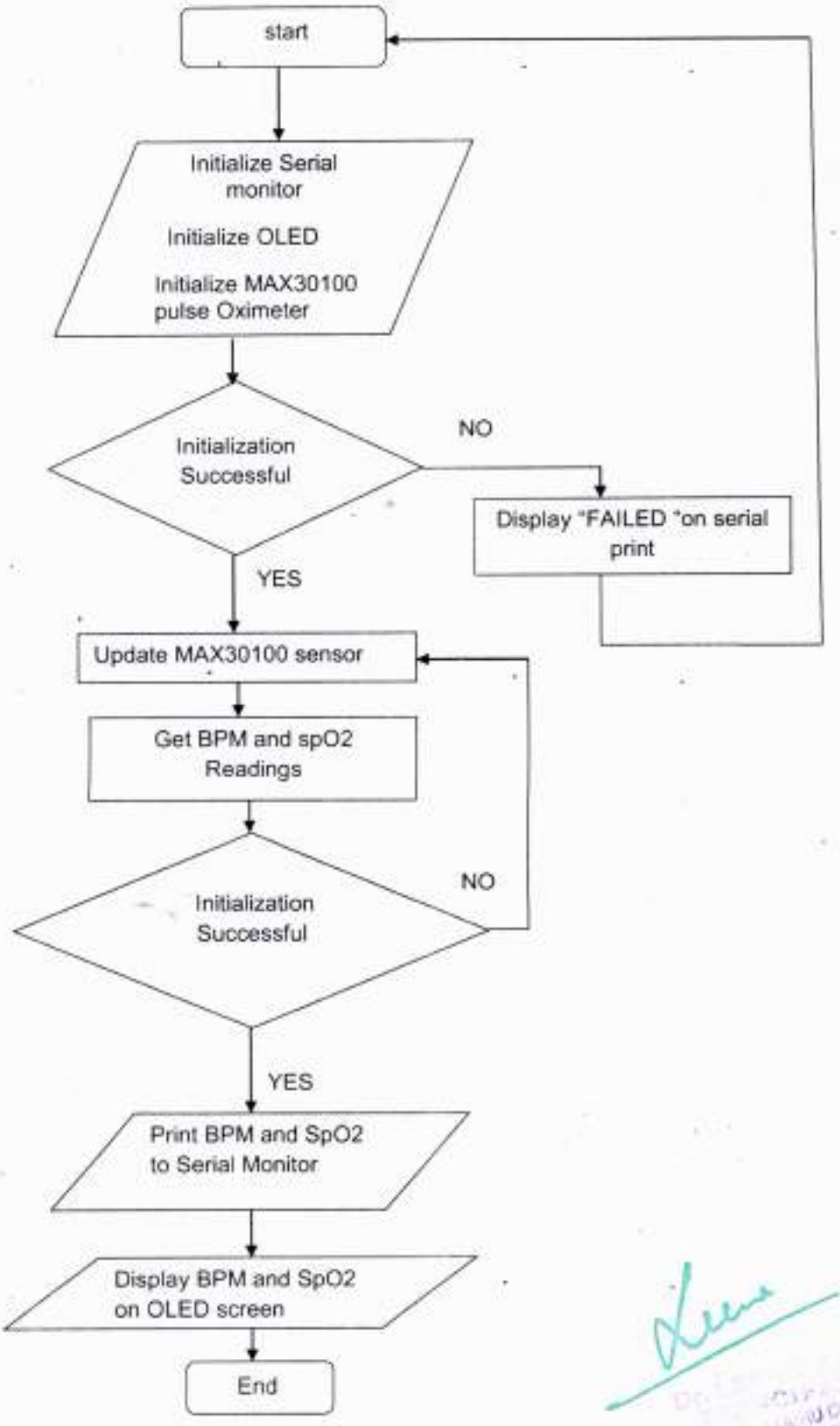


Fig 6. 1 (a) Hardware Section Flowchart

6.1(b) Software Section Flowchart



CHAPTER 7

FEATURES

7.1 ADVANTAGES

- giving a clear indication and evaluation of the condition of cardiovascular system during physical activity
- The device is portable, durable hence could be used by any individual in the proposed region even if not a cardiologist.
- It can be easily used by individual for lifestyle analysis This device could be used in clinical and nonclinical environments

7.2 DISADVANTAGES

- Limitation to accurately measure heart rate through tattooed skin.
- Heart rate monitors cannot distinguish accurately between light and moderate intensity activities.
- Distance with skin and sensor effects

7.3 FUTURE SCOPE

In the future, IoT can make the healthcare industry more efficient, accurate, and cheaper. It can also help in developing more patient-oriented and customized equipment. Moreover, IoT will also help patients to have hassle-free visits to hospitals, easy treatments, and access to more and more information. For IoT applications, we have successfully built equipment to test oxygen saturation and pulse rate. Both data are sent to the cloud successfully and are widely accessible through sites

CHAPTER 8

CONCLUSION

We interface MAX30100 Pulse Oximeter with NodeMCU ESP8266. We monitor the Blood Oxygen & Heart Rate. The pulse oximeter available in the market is very expensive, but with this simple & low-cost pulse oximeter module, we can make our own device. So we make MAX30100 Pulse Oximeter with ESP8266.design process of a low cost and portable microcontroller based heart-rate counting system for monitoring heart condition that can be implemented with off-the-shelf components. The proposed system is applicable for family, hospital, clinic, community medical treatment, sports healthcare and other medical purposes

REFERENCES

Vikramsingh R. Parihar , Akesh Y. Tonge , Pooja D. Ganorkar(2017) Heartbeat and Temperature Monitoring System forRemote Patients using Arduino.

Mohamad Nur Aiman Jam Lilywati bakar, Zurina Abdul wahab (2022)"Heart Rate Monitoring Robot by Using Arduino and NodeMCUESP8266.

Karan A. Zaveri1 , Mihir H. Amin2 , Margiv S. Amin , Mansi R. Patel.(2021)IoT based real time low cost home quarantine patient aid system using blynk app.

APPENDIX

PROGRAM

```
include <Wire.h>

#include "MAX30100_PulseOximeter.h

#include <ESP8266WiFi.h>

#include "Adafruit_GFX.h"

#include "OakOLED.h"

#define REPORTING_PERIOD_MS 1000OakOLEDoled;

// Connections : SCL PIN - D1 , SDA PIN - D2 , INT PIN - D0

PulseOximeter pox;

float BPM, SpO2;

uint32_t tsLastReport = 0;

const unsigned char bitmap [] PROGMEM =

{

 0x00, 0x00, 0x00, 0x00, 0x01, 0x80, 0x18, 0x00, 0x0f, 0xe0, 0x7f, 0x00, 0x3f, 0xf9, 0xff,
0xc0,  0x7f, 0xf9, 0xff, 0xc0, 0x7f, 0xff, 0xff, 0xe0, 0x7f, 0xff, 0xff, 0xe0, 0xff, 0xff, 0xff, 0xf0,
0xff, 0xf7, 0xff, 0xf0, 0xff, 0xe7, 0xff, 0xf0, 0xff, 0xe7, 0xff, 0xf0, 0x7f, 0xdb, 0xff, 0xe0,  0x7f,
0x9b, 0xff, 0xe0, 0x00, 0x3b, 0xc0, 0x00, 0x3f, 0xf9, 0x9f, 0xc0, 0x3f, 0xfd, 0xbf, 0xc0,  0x1f,
0xfd, 0xbf, 0x80, 0x0f, 0xfd, 0x7f, 0x00, 0x07, 0xfe, 0x7e, 0x00, 0x03, 0xfe, 0xfc, 0x00,
0x01, 0xff, 0xf8, 0x00, 0x00, 0xff, 0xf0, 0x00, 0x00, 0x7f, 0xe0, 0x00, 0x00, 0x3f, 0xc0, 0x00,
0x00, 0x0f, 0x00, 0x00, 0x00, 0x06, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00, 0x00,
0x00};

void onBeatDetected(

{Serial.println("Beat Detected!");

oled.drawBitmap( 60, 20, bitmap, 28, 28, 1);

oled.display();

}


voidsetup()

{

Serial.begin(115200);

oled.begin();
```

```
oled.clearDisplay();
oled.setTextSize(1);
oled.setTextColor(1);
oled.setCursor(0, 0);
oled.println("Initializing pulse oximeter..");
oled.display();
pinMode(16, OUTPUT);
Serial.print("Initializing Pulse Oximeter..");
 if (!pox.begin()) {Serial.println("FAILED");
oled.clearDisplay();
oled.setTextSize(1);
oled.setTextColor(1);
oled.setCursor(0, 0);
oled.println("FAILED");
oled.display();
for (;;);
}
else
{
oled.clearDisplay();
oled.setTextSize(1);
oled.setTextColor(1);
oled.setCursor(0,0);

oled.println("SUCCESS");
oled.display();
Serial.println("SUCCESS");
pox.setOnBeatDetectedCallback(onBeatDetected);
```

```
}
 // The default current for the IR LED is 50mA and it could be changed by uncommenting the
following line.
//pox.setIRLedCurrent(MAX30100_LED_CURR_7_6MA);
}void loop()
{
pox.update();
//Blynk.run();
 BPM = pox.getHeartRate();
  SpO2 = pox.getSpO2();
   if (millis() - tsLastReport> REPORTING_PERIOD_MS)
  {
Serial.print("Heart rate:")
;Serial.print(BPM);
Serial.print(" SpO2:");
Serial.print(SpO2);
Serial.println(" %");

oled.clearDisplay();
oled.setTextSize(1);
oled.setTextColor(1);
oled.setCursor(0, 16);

oled.println(pox.getHeartRate());
oled.setTextSize(1);
oled.setTextColor(1)
;oled.setCursor(0, 0);
oled.println("Heart BPM");
oled.setTextSize(1);
```

```
oled.setTextColor(1);
oled.setCursor(0, 30);
oled.println("Spo2");
oled.setTextSize(1);
oled.setTextColor(1);o
led.setCursor(0, 45);
oled.println(pox.getSpO2());
oled.display();
tsLastReport = millis();
 }
}
```

HOD ECE