Visvesvaraya Technological University

Jnana Sangama, Belagavi - 590018

INTERSHIP REPORT (18CSI85)

On

"Stock Market Prediction"

Submitted in partial fulfillment of the requirements for the award of the Degree of

**BACHELOR OF
ENGINEERING IN
COMPUTER SCIENCE AND ENGINEERING**

Submitted by

GAGANA R

1KS20CS029

Internship Carried Out At

TechCiti Software Consulting Private Limited

Internal Guide	External Guide
Mr. Somasekhar T	Mrs. Kasthuri Krishnan
Associate Professor	Software Developer
Dept. of CSE, KSIT	TechCiti Software
	Consulting Private
	Limited

Department of Computer Science and Engineering

K S INSTITUTE OF TECHNOLOGY

No. 14, Raghuvanahalli, Kanakapura Main Road, Bangalore – 560109

2023 – 2024

COMPANY CERTIFICATE

TechCiti Software Consulting Private Limited

CIN: U72900KA2018PTC117376   D-U-N-S No. : 86 14 54180

No. 22 23 24 25/101, BNR Complex, J.P. Nagar, Bengaluru, Karnataka 560078.
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Ref.No.TSCPL/2023-2024/HRD/INT6012

Date: 27th September, 2023

TO WHOMSOEVER IT MAY CONCERN

We would like to inform you that Ms. **Gagana R** has successfully completed her internship with our company, she has been working on the project title: **"Stock Market Prediction"** from 22-08-2023 to 22-09-2023 as "Data Science-Intern".

We have found her to be a self –starter who is motivated, duty-bound and hardworking. She has worked sincerely on her assignments and her performance is at par excellence.

We wish her all the best for her future endeavors.

Sincerely,

Manager
Human Resources Department
TechCiti Software Consulting Private Limited.

EXECUTIVE SUMMARY

I, GAGANA R bearing the USN 1KS20CS029 studying in the 8th semester of Bachelor of Engineering in Computer Science and Engineering at K S Institute of Technology, Bengaluru, hereby declare that the Internship Report entitled "Stock Market Prediction", is a record of original work based on the Internship carried out at TechCiti Software Consulting Private Limited. Under the External Guidance of Mrs. Kasthuri Krishnan, TechCiti Software Consulting Private Limited and Internal Guidance of Mr. Somasekhar T, Associate Professor, Computer Science & Engineering, K. S. Institute of Technology. The Internship Report has been submitted in partial fulfillment of the requirements for the award of the degree of Bachelor of Engineering in Computer Science and Engineering. The results embodiedin this report have not been submitted to any other University or Institute for the award of any degree.

Place:

Date:

GAGANA R

1KS20CS029

DECLARATION

During my internship at TechCiti Software Consulting Private Limited, I had the privilege to contribute to an exciting project focused on Stock Market Prediction leveraging advanced data science techniques. This project was designed to empower investors with predictive insights into future stock prices, aligning perfectly with TechCiti's dedication to cutting-edge technological solutions in finance.

Over the course of a month, I played a pivotal role in collaborating with a diverse team of professionals at TechCiti, working towards the development of a predictive model tailored for stock market forecasting.

Collaborative Approach: Throughout the internship, I actively collaborated with cross-functional teams within TechCiti Software Consulting Private Limited, including engineers, project managers, and military personnel. This collaborative approach ensured that the developed solution aligned closely with the needs and expectations of end-users.

Problem Solving: During the internship, I used a systematic approach to problem-solving, demonstrating the ability to break down complex problems into manageable tasks and apply appropriate data science methodologies to derive meaningful insights from the dataset.

Communication Skills: In the later parts of the internship, I have worked upon my communication skills and presentation skills by effectively presenting the findings and insights to both technical and non- technical audiences and received good remarks.

GAGANA R
1KS20CS029

ACKNOWLEDGEMENT

The successful completion of the seminar would be incomplete without the mention of the people who made it possible and whose constant guidance crowned my effort with success.

I take this opportunity to express my sincere gratitude to our Management K S Institute of Technology, Bengaluru for providing the environment to present the seminar.

I would like to express our gratitude to **Dr. K.V.A Balaji , CEO**, K.S Group of Institutions Bengaluru, for his valuable guidance.

I would like to express our gratitude to **Dr. Dilip Kumar K**, **Principal/Director**, K.S. Institute of Technology, Bengaluru, for his continuous support.

I like to extend our gratitude to **Dr. Rekha.B.Venkatapur**, **Professor and Head**, Department of Computer Science & Engineering, for providing a very good facilities and encouragement.

I also like to thank our Internship Coordinators, **Mrs. Rashmi H, Asst. Professor, Mr.Somasekhar T, Associate Professor, Department of Computer Science & Engineering** for their help and support.

Also, I am thankful to **Mr. Somasekhar T, Associate Professor, Department of computer science & Engineering**, for being our internship guide, for his constant support and guidance.

I sincerely thank and acknowledge guidance and constant encouragement of my internship guide **Mrs. Kasthuri Krishnan, TechCiti Software Consulting Private Limited**, for their valuable guidance and advice at every stage of our project which helped me in the successful completion of my project.

Finally, I would like to thank all the teaching and non-teaching staff of the college for their cooperation. Moreover, I thank all my family and friends for their invaluable support and cooperation.

GAGANA R
1KS20CS029

I

ABSTRACT

The internship project at TechCiti Software Consulting Private Limited centered around leveraging advanced data science techniques for Stock Market Prediction. The overarching goal was to develop a predictive model that empowers investors with insights into future stock prices. This initiative resonated with TechCiti's commitment to pioneering technological solutions in finance.

During the internship, the focus was on collaborating with a multidisciplinary team to develop and refine the predictive model. The project spanned a month, during which I played a crucial role in contributing to various stages of development.

Key components of the project included data collection from sources like Yahoo Finance API, preprocessing of the collected data to prepare it for modeling, and model training using algorithms such as Linear Regression. Additionally, prediction of future stock prices and visualization of results were integral parts of the project.

Throughout the internship, emphasis was placed on teamwork, problem-solving, and effective communication. This allowed for the seamless integration of individual contributions towards the common goal of creating a robust predictive model for stock market forecasting.

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Chapter 1

INTRODUCTION

Computer Science Engineering presents a vast array of career avenues, spanning industries like software development, telecommunications, cybersecurity, data analysis, and artificial intelligence. Graduates are equipped for diverse roles such as software engineer, systems analyst, network engineer, database administrator, machine learning engineer, and cybersecurity specialist.

Internships serve as invaluable opportunities for students to cultivate and refine their technical prowess within their chosen field. Through hands-on experience with industry-standard tools, technologies, and methodologies, interns develop proficiency in crucial areas like programming, software development, data analysis, and networking. These experiences not only familiarize students with the professional work environment but also provide them with a deep understanding of their target industry. By gaining insights into industry practices, trends, and challenges, interns are better equipped to meet the expectations and demands of the real world workplace.

For those aiming to carve a path as machine learning engineers or analysts, this internship offers an exceptional chance to dive into a vibrant and cutting-edge setting. TechCiti Software Consulting Private Limited stands out as a trailblazer in leveraging machine learning solutions to tackle intricate issues spanning various sectors. During this internship, participants will delve deeply into the nuances of machine learning, guided by seasoned professionals every step of the way.

Under the mentorship of industry leaders, interns will acquire hands-on experience with machine learning pipelines and workflows, honing their ability to extract actionable insights from intricate datasets. This internship offers a transformative experience, empowering participants to make significant contributions to the evolution of machine learning technology.

Chapter 2

COMPANY PROFILE

Fig 2.1 : Company logo

TechCiti Software Consulting Private Limited is a company which recognize the importance of implementing the right solution for your business. They offer a wide range of services to build a solution that is right for business needs. Every business, no matter the size, needs advice and support. They have several years of technical experience and have accumulated a wealth of IT infrastructure knowledge. Their free consultation service helps you to establish your requirements. They will be with us every step of the way, from product selection through to configuration and installation.

At TechCiti Software, thrive on tackling challenging tasks and disrupting the status quo to foster continuous improvement and innovation. Their core belief revolves around empowering individuals to learn, grow, and unleash their full potential. They foster a culture of collaboration, where teamwork is paramount, yet They also value and celebrate individual excellence. They encourage self-belief and trust within teams, recognizing that each member brings unique skills and perspectives to the table. At TechCiti, not just building software; cultivating an environment where creativity flourishes, ideas are embraced. Vision is centered on empowering both individuals and organizations to unlock their full potential by reshaping their engagement with technology. We envision a future where technology serves as a catalyst for transformative change, enabling people and businesses to redefine their roles and shape the future proactively. They have ambition not just about embracing the latest technological trends, but also about fostering a culture of continuous learning, adaptation, and evolution. they recognize that the future is dynamic and unpredictable, and are committed to helping individuals and organizations navigate this ever-changing landscape with confidence and agility.
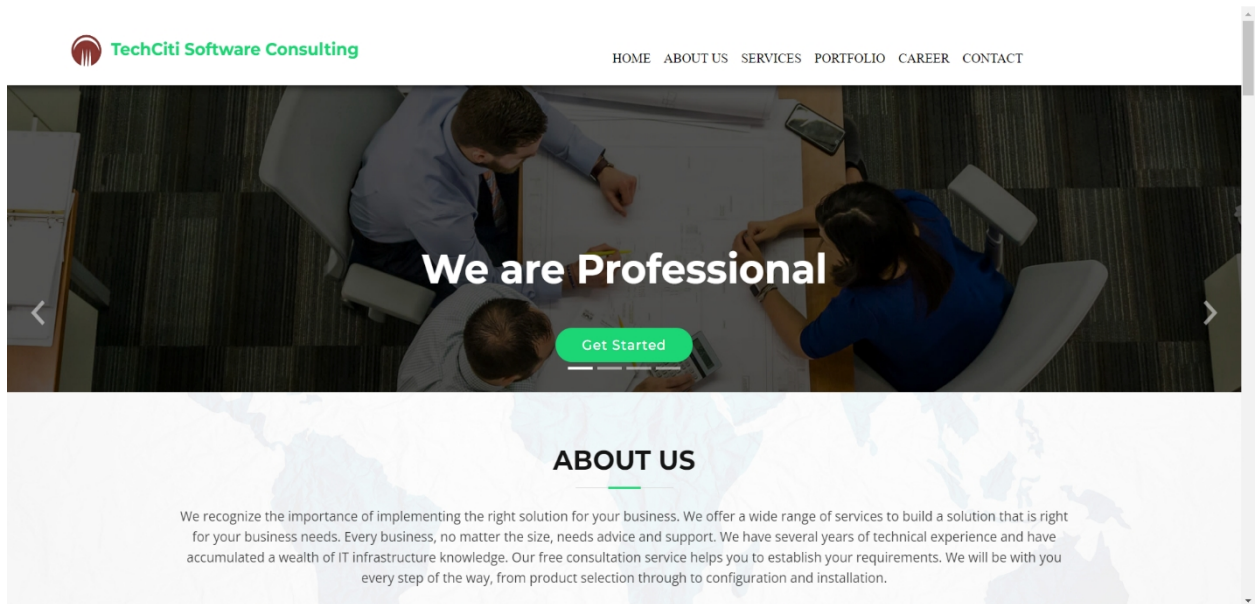
Fig 2.2 : Company website

Practical Application of Knowledge: Internships provide an opportunity for students to apply the theoretical knowledge gained in classrooms to real-world scenarios. It helps bridge the gap between academia and industry by allowing students to work on practical projects, solve problems, and gain hands-on experience.

Skill Development: Internships enable students to develop and enhance technical skills that are essential in their chosen field. They get to work with industry-standard tools, technologies, and methodologies, which helps them become proficient in areas such as programming, software development, data analysis, networking, and more.

Industry Exposure: Internships provide students with exposure to the professional work environment and the industry they aspire to work in. They gain insights into the industry's practices, trends, and challenges, helping them understand the expectations and demands of the real-world workplace.

Resume Building: Having internship experience on a resume is highly valued by employers. It demonstrates that students have practical experience, are motivated, and have exposure to the industry. Internships can make a student's resume stand out and increase their chances of securing full-time employment after graduation.

Personal and Professional Growth: Internships offer an opportunity for personal and professional growth. Students develop essential skills such as communication, teamwork, time management, problem-solving, and adaptability. They also gain insights into workplace dynamics, professionalism, and work ethics, which contribute to their overall development.

BUSINESS ACTIVITIES

RESPONSIVE DESIGN

we are committed to delivering outstanding responsive web design solutions that ensure your website looks stunning and functions seamlessly across all devices, including desktops, tablets, and phones. Our approach to responsive web design goes beyond simply resizing elements to fit different screen sizes. We meticulously craft each aspect of your website to adapt fluidly to various devices, maintaining optimal usability and visual appeal regardless of the screen dimensions. Through thorough testing and optimization, we ensure that your website not only looks great but also performs flawlessly across different platforms and browsers. Whether your audience is accessing your site from a desktop computer, a tablet, or a smartphone, they can expect a consistent and enjoyable browsing experience. With our responsive web design solutions, you can confidently reach and engage your target audience across a diverse range of devices, effectively enhancing your online presence and driving business growth.

ENTERPRISE SOFTWARE SOLUTION

We have deployed database applications on various frameworks for sectors like retail, logistics and supply chain. Development of CRM/ERP systems with cloud connectivity has been our forte. In the logistics and supply chain industry, efficiency and accuracy are paramount. Our solutions enable businesses to track shipments, manage inventory across multiple locations, and optimize route planning to minimize costs and maximize efficiency. With cloud connectivity, stakeholders can access critical data anytime, anywhere, ensuring seamless collaboration and decision-making. Our CRM/ERP systems are built with scalability and flexibility in mind, allowing businesses to adapt to evolving market trends and changing customer demands. Whether it's managing sales pipelines, automating workflows, or analyzing performance metrics, our solutions empower organizations to make informed decisions and drive growth.

E-COMMERCE SOLUTION and CORPORATE SOLUTION

At TechCiti Software, we specialize in building visually appealing eCommerce platforms that focus on branding, customer engagement, and boosting conversions. Our platforms offer immersive experiences, personalized features, and robust performance to drive long-term success for your online business. Successful change management requires well-defined objectives and effective strategies to inspire and engage employees in achieving these goals.

Chapter 3

INTERNSHIP TASK

3.1 Overview

During my internship at TechCiti Software Consulting Private Limited, I was involved in a project aimed at Stock Market Prediction using advanced data science techniques. The project sought to empower investors by providing predictive insights into future stock prices, aligning with TechCiti's commitment to cutting-edge technological solutions in finance. Over the course of a month, I collaborated closely with a diverse team of professionals at TechCiti, contributing to the development of a tailored predictive model for stock market forecasting. From data collection to website development, every stage of the project was meticulously planned and executed to deliver a comprehensive solution to investors.

3.2 Purpose of this project

The primary purpose of this project was to develop a predictive model that enables investors to make informed decisions by forecasting future stock prices. By leveraging advanced data science techniques, the project aimed to provide investors with valuable insights into market trends and potential investment opportunities. This initiative aligned with TechCiti's vision of harnessing technology to drive innovation in finance, ultimately empowering individuals to navigate the complexities of the stock market with confidence. The project's overarching goal was to equip investors with a powerful tool that enhances their ability to anticipate market movements and optimize their investment strategies accordingly.

3.3 Scope of the project

The scope of the project encompassed various stages, beginning with data collection from the Yahoo Finance API to fetch historical stock market data for specified ticker symbols. Data preprocessing involved defining the prediction timeframe, shifting adjusted closing prices, and scaling features for uniformity. Model training utilized the Linear Regression algorithm to predict future stock prices, followed by the evaluation of model performance through confidence score calculation. The project also included plotting predicted data using Plotly for interactive visualization and displaying ticker information retrieved from a CSV file. Furthermore, website development using the Django framework facilitated user-friendly access to predictive insights and stock market trends.

3.4 Literature Survey

3.4.1 Predicting Stock Market Trends Using Machine Learning and Deep Learning Algorithms Via Continuous and Binary Data; a Comparative Analysis

This study aimed to enhance the accuracy of stock market trend prediction by employing machine learning and deep learning algorithms. Four distinct stock market groups, including diversified financials, petroleum, non-metallic minerals, and basic metals from the Tehran stock exchange, were selected for evaluation. Leveraging a dataset comprising ten years of historical records with ten technical features, the study compared the performance of nine machine learning models (Decision Tree, Random Forest, Adaboost, XGBoost, SVC, Naïve Bayes, KNN, Logistic Regression, and ANN) and two deep learning methods (RNN and LSTM) as predictors. Two approaches were considered for input values: treating technical indicators as continuous data derived from stock trading values and converting indicators into binary data. Evaluation metrics were applied to assess the models' performance under both approaches.

The findings revealed that utilizing deep learning algorithms, specifically RNN and LSTM, yielded superior predictive capabilities compared to traditional machine learning models across both input data approaches. Notably, there was a marked improvement in model performance when employing binary data, indicating the effectiveness of this approach in enhancing prediction accuracy. The study underscores the significance of deep learning techniques in stock market trend prediction, particularly when considering technical indicators in binary form, thereby providing investors with valuable insights for informed decision-making in volatile financial markets.

3.4.2 A Stock Price Prediction Method Based on BiLSTM and Improved Transformer

This article introduces a novel approach, BiLSTM-MTRAN-TCN, aimed at enhancing the accuracy and stability of stock price prediction to maximize shareholder returns. The proposed method combines Bi-directional Long Short-Term Memory (BiLSTM) with a modified Transformer model integrated with Temporal Convolutional Network (TCN), termed MTRAN-TCN. By leveraging the strengths of these models, BiLSTM-MTRAN-TCN is adept at capturing both long-range dependencies and bidirectional information within sequences, thus improving the predictive capabilities of the model. The Transformer model, known for its ability to capture long-range dependencies, is enhanced by incorporating TCN, which improves sequence dependency capture and generalization ability. Through empirical evaluation on a

dataset comprising 5 index stocks and 14 Shanghai and Shenzhen stocks, the effectiveness of the proposed method is demonstrated. Comparative analysis against existing methods in the literature reveals that BiLSTM-MTRAN-TCN exhibits superior fit on each index stock and achieves the best R2 performance in 85.7% of the stock dataset. Additionally, the proposed method demonstrates a notable reduction in Root Mean Square Error (RMSE) by 24.3% to 93.5%, accompanied by an increase in R2 by 0.3% to 15.6%. Importantly, BiLSTM-MTRAN-TCN showcases stable prediction performance across different time periods without succumbing to timeliness issues, indicating its robustness in predicting stock prices with high accuracy and generalization ability.

3.4.3 Cost Harmonization LightGBM-Based Stock Market Prediction

In this paper, the authors address the challenge of stock market prediction (SMP) by proposing a novel approach called cost-harmonization loss-based LightGBM (CHL-LightGBM). Traditional machine learning models like artificial neural networks (ANNs) and support vector regression (SVR) have been effective in minimizing prediction errors, but in the context of SMP, it's crucial to consider the associated costs of these errors. The proposed CHL-LightGBM method introduces a dynamic cost calculation mechanism based on the difficulty of each datum, allowing for a more nuanced approach to minimizing trading costs. By embedding this cost-harmonization loss (CHL) into LightGBM, the model can adaptively balance the cost and difficulty among examples during the training process. Experimental results conducted on data from Shanghai, Hong Kong, and NASDAQ Stock Exchanges demonstrate the effectiveness of CHL-LightGBM, outperforming traditional models like LightGBM, XGBoost, and decision trees in terms of profitability, risk control, and predictive accuracy.

Moreover, CHL-LightGBM holds promise for cost-sensitive classification applications beyond stock market prediction, including anomaly detection, defect detection, medical diagnosis, and credit card fraud detection. The study highlights the practical implications of CHL-LightGBM in various domains where accurate and cost-sensitive predictions are paramount. Additionally, the authors outline avenues for future research, emphasizing the importance of interpretability in machine learning models like LightGBM through techniques such as SHAP values and individual conditional expectation (ICE) diagrams. These interpretability techniques offer insights into feature importance and their impact on predictions, enhancing the model's transparency and utility in real-world applications.

3.5 System Requirements Specification

3.5.1 Hardware Requirements:

• Central Processing Unit (CPU): AMD Radeon/Intel Core i5.

• RAM: 8 GB.

• Memory: 10 GB minimum free space.

• Operating System: Linux Mint /Windows 10 and above.

3.5.2 Software Requirements

• Visual Studio code / Jupyter notebook / Anaconda Python 3

• Libraries: numpy, pandas, sklearn, html collections.

3.6 Dataset

The dataset utilized in this project comprises historical stock market data sourced from the Yahoo Finance API. It encompasses a range of essential features such as opening price, closing price, highest price, lowest price, and trading volume for a given ticker symbol over a specified time period. The dataset is organized in a tabular format, with each row representing data for a particular trading day and each column representing a distinct attribute of the stock. It is crucial to ensure the dataset spans a sufficiently long timeframe to capture diverse market conditions and fluctuations. Additionally, the dataset may include supplementary information such as dividend adjustments and stock splits, which are essential for accurately modeling stock price movements. Understanding the structure and content of the dataset facilitates informed decision-making throughout the prediction process.

3.7 Data Analysis

Before delving into preprocessing, a comprehensive data analysis is crucial to comprehend the underlying patterns and characteristics within the historical stock market data. This analysis involves visually inspecting the data through various plots such as time series plots to observe trends over time, scatter plots to identify potential correlations between variables, and histograms to understand the distribution of the data. Statistical measures like mean, median, standard deviation, and skewness provide insights into the central tendency, variability, and symmetry of the data distribution. Exploring these aspects helps in identifying outliers or

anomalies that might require further investigation or treatment during preprocessing. Moreover, the data analysis phase aids in understanding any seasonality, cyclicality, or other recurring patterns present in the dataset, which could influence the selection of appropriate forecasting models.

3.8 Algorithms and Methodologies

In the data preprocessing stage, a range of techniques is employed to meticulously prepare the dataset for subsequent model training. Beyond standardization or normalization of features to ensure consistent scale, additional steps such as handling missing data, outlier detection and removal, and feature engineering may be performed to enhance the quality of the dataset. Moreover, rather than simply shifting adjusted closing prices for future predictions, advanced time-series preprocessing methods like differencing, lagging, and rolling window statistics may be employed to capture temporal dependencies and patterns inherent in the data. These techniques are crucial for ensuring that the input data is appropriately structured and informative for training the predictive models.

When it comes to model selection and training, the approach extends beyond just linear regression. While linear regression may serve as a baseline, more advanced machine learning algorithms and methodologies are explored to capture the complex and nonlinear relationships present in stock market data. Techniques such as Support Vector Regression (SVR), Random Forest Regression, Gradient Boosting Regression, and ensemble methods are considered to harness the predictive power of diverse modeling approaches. Additionally, deep learning architectures like Long Short-Term Memory (LSTM) networks and Convolutional Neural Networks (CNNs) may be leveraged to capture intricate temporal dependencies and patterns in the data. Model evaluation is conducted using a suite of performance metrics including Mean Squared Error (MSE), Root Mean Squared Error (RMSE), Mean Absolute Error (MAE), and R-squared to comprehensively assess the accuracy, robustness, and generalization ability of the trained models. Techniques like cross-validation and hyperparameter tuning are also employed to optimize model performance and ensure the reliability of predictions in real-world scenarios.

3.9 Website Development using Django

In tandem with data analysis and model development, the project incorporates website development utilizing the Django framework. Django, renowned for its simplicity and versatility, facilitates the creation of robust web applications with minimal effort. The

development process involves crafting an intuitive user interface that seamlessly integrates with the backend functionality, ensuring a smooth user experience. Leveraging Django's powerful features such as built-in authentication, security mechanisms, and database management capabilities, the website is designed to provide users with a comprehensive platform for accessing predictive insights into stock market trends.

The development workflow entails designing views and templates to render dynamic content, implementing functionalities to fetch historical stock market data using the Yahoo Finance API, and presenting the predictions in an interactive and visually appealing manner. With Django's scalability and flexibility, the website can efficiently handle user requests, process data, and deliver accurate predictions in real-time. By leveraging Django's modular structure and extensive ecosystem of plugins and libraries, the project aims to deliver a sophisticated web application that empowers investors with actionable insights to make informed decisions in the dynamic realm of stock market trading.

Chapter 4

REFLECTION

Learning Outcomes

Acquire Technical Proficiency:

The goal is to actively pursue learning and refining technical skills pertinent to your field of study or the specific projects undertaken during your internship. This encompasses mastering programming languages, becoming adept with software tools, understanding hardware components, or any other technical competencies essential for your role. By immersing yourself in these learning endeavors, you aim to enhance your proficiency and contribute effectively to project objectives. This proactive approach not only fosters personal growth but also enriches your professional capabilities, enabling you to tackle challenges and make meaningful contributions in your field.

Gain Insight into Company Operations:

Utilize your internship as a platform to gain a deeper understanding of how TechCiti Software Consulting Private Limited functions as an organization. This entails familiarizing yourself with its organizational framework, comprehending its business procedures, delving into the product development lifecycle, and acquiring any industry-specific knowledge pertinent to your position.

Make Meaningful Contributions to Projects:

Set a clear objective to actively participate in the projects or assignments assigned to you throughout your internship tenure. Strive to execute tasks in a punctual manner and produce work of exceptional quality that enriches the project and team dynamics. By adhering to deadlines and delivering outputs that contribute value, you aim to make tangible and impactful contributions to the overarching objectives of the project and the collective success of the team. This proactive approach not only demonstrates your commitment and professionalism but also cultivates a reputation for reliability and excellence within the organization.

Enhance Soft Skill Development:

Recognize the significance of soft skills alongside technical expertise in professional settings. Identify areas for improvement in essential skills such as communication, teamwork, time management, problem-solving, and adaptability. Actively seek opportunities to collaborate with colleagues, engage in team meetings, and effectively communicate with stakeholders. By honing these skills, you not only enhance your professional effectiveness but also foster stronger relationships, facilitate smoother workflows, and contribute positively to team dynamics. Embracing these opportunities for growth demonstrates your commitment to personal and professional development, ultimately positioning you as a valuable asset within the organization.

Cultivate Professional Connections and Relationships:

Proactively engage in networking activities with professionals at TechCiti Software Consulting Private Limited, including managers, mentors, and fellow interns. Foster meaningful relationships with colleagues who can offer valuable guidance, support, and potential references for future endeavors. By actively building these connections, you not only expand your professional network but also create opportunities for mentorship, collaboration, and career advancement within the organization. Cultivating these relationships demonstrates your commitment to personal and professional growth while fostering a supportive and collaborative work environment.

Stay Informed about Industry Trends:

Remain abreast of the most recent trends, advancements, and technologies within the defense electronics industry or your specific area of interest. Take advantage of opportunities to attend seminars, workshops, or industry events, if feasible, and actively participate in discussions with industry experts to expand your knowledge base. By immersing yourself in these learning opportunities, you not only stay informed about the latest developments but also gain valuable insights into emerging trends and future directions within the industry. This proactive a pproach to staying updated enhances your expertise and positions you as a knowledgeable and forward thinking professional within your field.

Engage in Reflective Evaluation:

Allocate time periodically to reflect on your internship journey and assess your achievements, hurdles encountered, and areas of personal and professional development. Identify key lessons learned from your experiences and consider how they can be applied to your future academic and career pursuits. Reflect on the skills acquired, challenges overcome, and insights gained, and discern their relevance to your long-term goals and aspirations.

Chapter 5

RESULTS

Upon accessing the website, users are greeted with real-time trends of stock prices, providing a snapshot of current market conditions. Additionally, users are presented with the option to input the ticker symbol of a company, along with the number of days for which they seek predictions. Leveraging the predictive model developed using advanced machine learning and deep learning algorithms, the website generates forecasts for the specified stock, visually depicting the predicted trends over the designated timeframe. This interactive feature empowers users to make informed decisions regarding their investments by providing them with actionable insights into future stock price movements.

Furthermore, the website offers comprehensive information about the entered ticker symbol, including details such as the company name, last sale price, and other relevant information. This enables users to gain a holistic understanding of the company and its stock performance before making investment decisions. By seamlessly integrating real-time data visualization and predictive analytics, the website enhances user engagement and facilitates efficient navigation of the dynamic stock market landscape. Overall, the results underscore the utility and effectiveness of the predictive model in empowering users with timely and accurate stock price forecasts for informed decision-making.
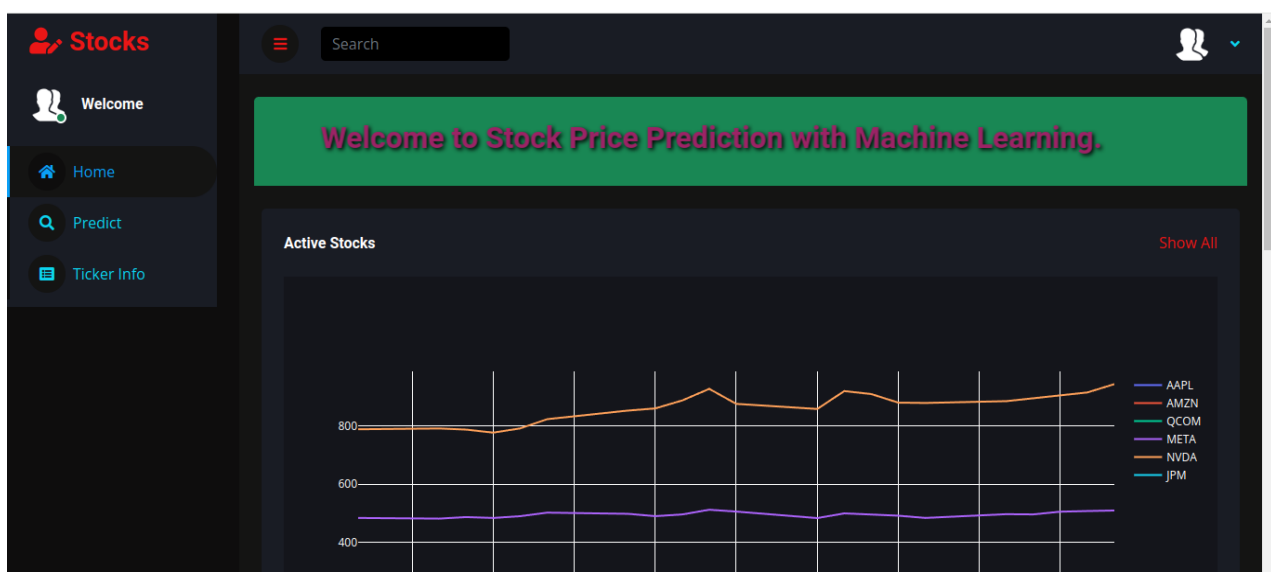
Fig 5.1: Stock Price prediction- Home page

Fig 5.2 : Plots of predicted stock price

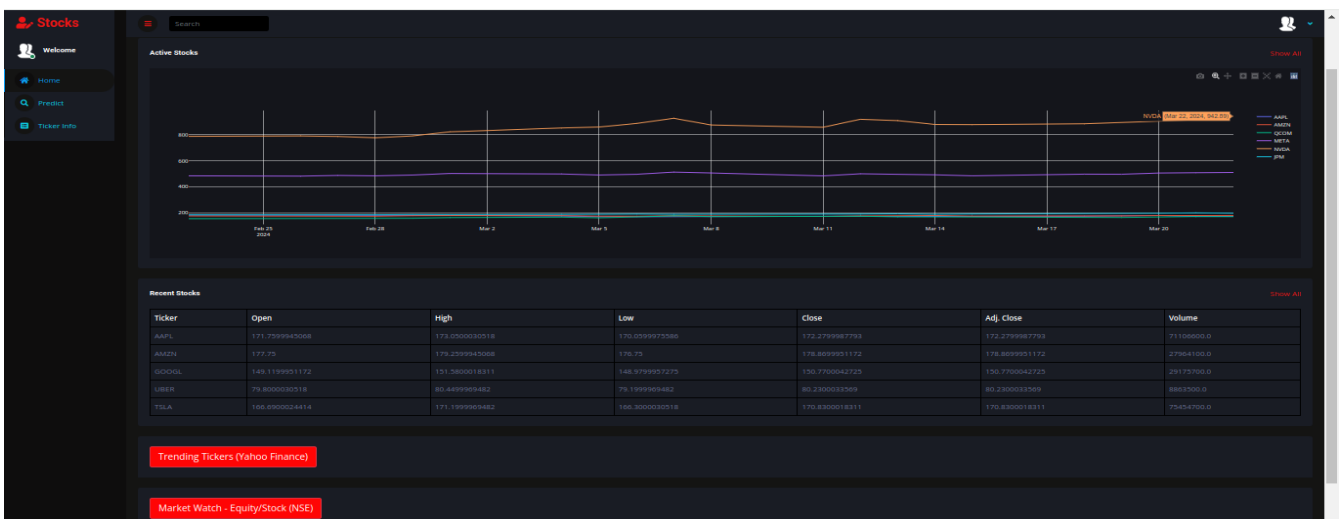**Fig 5.3 :** Tickers Information

Fig 5.4: Active and recent stocks

Chapter 6

CONCLUSION

I extend my sincere appreciation to TechCiti Software Consulting Private Limited for granting me the invaluable opportunity to serve as an intern. My tenure at TechCiti has been profoundly enriching, affording me the chance to broaden my knowledge and cultivate essential skills crucial for my professional growth. I am deeply grateful for the unwavering guidance, support, and mentorship extended to me, particularly by Mrs. Kasthuri Krishnan, whose dedication has been instrumental in shaping my learning journey. The encouragement and insights provided by the committed professionals at TechCiti have not only facilitated my personal and professional development but have also fostered a nurturing environment conducive to exploration and innovation. As I reflect on my time at TechCiti, I am filled with gratitude for the invaluable experiences and opportunities that have contributed to my growth and prepared me for future endeavors. I am truly honored to have been a part of such a dynamic and esteemed organization, and I look forward to applying the knowledge and skills gained during my internship to make meaningful contributions in my future endeavors.

The internship experience at TechCiti Software Consulting Private Limited has been transformative, significantly enhancing my comprehension of the industry while instilling me with the confidence and expertise necessary to navigate future career endeavors. The invaluable lessons learned and experiences gained during my tenure will serve as guiding beacons throughout my professional journey. As I embark on new challenges and ventures in my career, I carry with me the invaluable knowledge and skills acquired during my internship at TechCiti. I am confident that the lessons learned and experiences gained will continue to serve as pillars of strength, empowering me to overcome obstacles and achieve success in all my future endeavors. I extend my heartfelt gratitude to TechCiti Software Consulting Private Limited for the extraordinary opportunity and for being an integral part of my journey towards professional excellence.

Chapter 7

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VISVESVARAYA TECHNOLOGICAL UNIVERSITY

Gnana Sangana, Belgaum – 590002, Karnataka

An

INTERNSHIP REPORT ON

"ECG MONITORING SYSTEM using IoT"

By

THEERTHANA S R: 1KS19EC098

Submitted in partial fulfillment for the award of

BACHELOR OF ENGINEERING

IN

ELECTRONICS AND COMMUNICATION ENGINEERING

Carried out at

TECHNOLOGICS GLOBAL Pvt Ltd.

Under the guidance of

Internal Guide   External Guide

Mr. Sampath Kumar S   Ms. Divya Shree,
Assistant Professor   Embedded engineer,
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Bangalore – 560109

Department of Electronics and Communication Engineering

Certificate

**This is to certify that the Internship work entitled
"ECG MONITORING SYSTEM using IoT"**

Carried out by

THEERTHANA S R: 1KS19EC098

is a bonafide work done at Technologics Global Pvt Ltd India, Bangalore, in partial fulfillment for the award of Bachelor of Engineering Degree in Electronics and Communication from Visvesvaraya Technological University, Belgaum during the year 2022-2023. It is certified that all corrections and suggestions indicated during internal assessment have been incorporated in the report deposited in the department library. The Internship report has been approved as it satisfies the academic requirements in respect of work prescribed for Bachelor of Engineering Degree.

Signature of Guide   Signature of HOD   Signature of Principal

HEAD OF THE DEPARTMENT
Dept. of Electronics & Communication Engg
EXTERNAL VIVA
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PRINCIPAL
K.S. INSTITUTE OF TECHNOLOGY
BENGALURU - 560 109.

Name of Examiners   Signature with Date

1. Saleem S Tevaramani   SST 19/5/23

2. Bhargavi Ananth   19/5/23

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THEERTHANA S R

ABSTRACT

Smart and cost-effective healthcare has been in increasing demand to meet the needs of growing human population and medical expenses. It is a known fact that country like India has become heart disease capital of the world. There is a urgent need to develop an effective health monitoring system, that can detect abnormalities of health conditions in time and make diagnoses according to the gleaned data. ECG monitoring is a widely studied and applied approach to diagnose heart diseases. However, existing portable wireless ECG monitoring systems cannot work without a mobile application, which is responsible for data collection and passing on the messages to doctors. Recent advances in mobile technology and cloud computing have inspired numerous designs of cloud-based health care services and devices. Within the cloud system, medical data can be collected and transmitted automatically to medical professionals from anywhere and feedback can be returned to patients through the network. In this paper, we propose a new method for ECG monitoring based on Cypress Wireless Internet Connectivity for Embedded Devices (WICED) Internet of Things (IoT) platform. ECG data are gathered using a wearable monitoring node and are transmitted directly to the IoT cloud using Wi-Fi.

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Chapter 1

ABOUT THE COMPANY

Figure 1 Logo of Technologics Global Pvt Ltd

Technologics Global Pvt Ltd.

Vision:

- To provide High quality, sustainable, User Friendly & cost-effective engineering services in the competitive edge to our valued customers exceeding their expectation.
- Promote reputed multi brand residential, commercial and Industrial automation products.
- Enabling superior experience for customers through world class technologies, Products and Service offerings.

Mission:

- To Recognize as a Global Brand in The Field of BMS, EMS, Automation & Controls. By Providing Comprehensive Solution & Seamless Integration to All Our Customers.
- To deliver the world class solutions & services to help our clients to achieve Overall Efficiency and Business profitability.

1.1 Company History

Technologics Global Private Limited is an unlisted private company incorporated on 08 November, 2016. It is classified as a private limited company and is located in Bangalore, Karnataka. Its authorized share capital is INR 10.00 lac and the total paid-up capital is INR 1.00 lac.

Technologics head-quartered in Bangalore, India. is established by technology pioneers having decades of experience across India & Middle East in controls and automation

industry. They offer a wide range of services, related to PLC, SCADA, Industrial Automation, Integrated Building Management System (IBMS), LabVIEW, ETAP, Mechanical Design (CAD / CAM / CAE), Oracle, JAVA JSP & Embedded systems for commercial,   residential   and   Industrial   sectors. Technologics commenced business trading as a designer and installer of multi brand controls, automation distribution systems, providing a complete range of Custom Installation services and has an extensive experience in the field of complex turn-key solutions development and integration. They propose, design, develop, train, install, integrate, operate and maintain the state-of-the-art IBMS/SCADA and the PLC automation systems and solutions. The services they offer span the full development / integration lifecycle from definition of requirements to field testing of implemented solutions.

1.2 Company Products and Services

They offer a wide range of services, related to PLC, SCADA, IBMS & Embedded systems for commercial, residential and Industrial sectors. They provide training and turnkey solutions in the field of Industrial, automation, BMS, HAS, Facility Management software's, Embedded, Robotic, IT verticals with edge of competitive in quality & price to our valued customers in the ground of sustainability. They are also master dealer & system integrator of multi brand residential, commercial and Industrial automation products. Our focus and growth will be on the technological outsourcing in the field of Industrial Automation, BMS, HVAC controls and other related sub systems in the Middle East and Indian subcontinent.

Chapter 2

INTRODUCTION

2.1 Introduction to Internet of Things (IoT)

IoT, or the Internet of Things, refers to the interconnection of physical devices, vehicles, buildings, and other items embedded with sensors, software, and network connectivity. This allows these devices to collect and exchange data, providing useful information and enabling new applications and services.

The concept of IoT has been around for several decades, but recent advancements in technology such as low-cost sensors, wireless connectivity, and cloud computing have made it more practical and accessible. With IoT, devices can communicate with each other and with humans, making it possible to monitor and control a wide range of systems and processes in real-time.

IoT has numerous applications across many industries, including smart homes, wearables, healthcare, transportation, agriculture, and manufacturing. IoT can also be used to optimize energy usage, improve public safety, enhance customer experiences, and enable new business models.

However, IoT also presents some challenges, such as security and privacy concerns, interoperability, and data management. As IoT continues to evolve, it will require a multidisciplinary approach involving technology, policy, and society to ensure its full potential is realized while minimizing any negative impacts.

The Internet of Things (IoT), also sometimes referred to as the Internet of Everything (IoE), consists of all the web-enabled devices that collect, send and act on data they acquire from their surrounding environments using embedded sensors, processors and communication hardware. These devices, often called "connected" or "smart" devices, can sometimes talk to other related devices, a process called machine-to-machine (M2M) communication, and act on the information they get from one another. Humans can interact with the gadgets to set them up, give them instructions or access the data, but the devices do most of the work on their own without human intervention. Their existence has been made possible by all the tiny mobile components that are available these days, as well as the always- online nature of our home and business networks.

2.2 Purpose of Study

The purpose of studying IoT is to gain a deep understanding of the various aspects and applications of this emerging technology. With IoT, physical objects are transformed into intelligent devices that can sense, communicate, and act upon their environment, which has significant implications for many industries and fields.

Studying IoT can help individuals and organizations to:

1. Understand the technical aspects of IoT: This includes understanding the architecture, protocols, and standards used for IoT devices and networks.

2. Identify potential applications: Studying IoT can help individuals and organizations to identify potential applications of IoT in different industries and fields, such as healthcare, agriculture, transportation, and smart cities.

3. Develop and implement IoT projects: Studying IoT can provide the knowledge and skills needed to design, implement, and manage IoT projects.

4. Understand the impact of IoT on society: IoT has the potential to transform how we live, work, and interact with each other. Studying IoT can help individuals and organizations to understand the social and ethical implications of this technology and how it can be used to address societal challenges.

5. Address security and privacy concerns: As with any emerging technology, IoT has security and privacy implications that need to be addressed. Studying IoT can help individuals and organizations to understand the risks and develop strategies to mitigate them.

Overall, studying IoT is essential for anyone interested in working with or developing this technology. It can help to identify new opportunities, develop innovative solutions, and shape the future of how we interact with the world around us.

2.3 Definitions of terms and concepts

1. Internet of Things (IoT): The interconnection of physical devices, vehicles, buildings, and other items embedded with sensors, software, and network connectivity.

2. Sensors: Devices that measure physical properties such as temperature, pressure, light, sound, and movement.

3. Actuators: Devices that convert electrical signals into physical actions, such as opening

a valve or turning on a motor.

4. Connectivity: The ability of IoT devices to communicate with each other and with other systems, such as cloud services or other devices.

2.4 Components comprising IoT:

- **IoT Hardware** – These include sensors, micro-controller devices for control, servers, an edge or gateway.

- **IoT software** – It includes mobile and web applications that are responsible for data collection, device integration, real-time analysis and application and process extension.
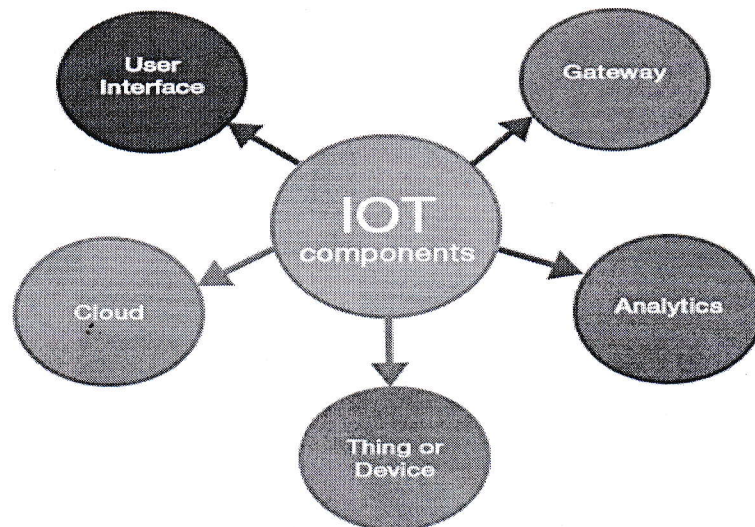
Figure 2.4 Components of IoT

- **Sensors and Actuators**: Sensing devices (thermostat, microphone) which interact with the environment and an actuator (Electric motor) for turning energy into motion.

- **Connectivity or Gateway**: A communication channel through which devices can communicate and share information.

- **Analytics**: Data coming from devices and sensors is converted into a format that is easy to read and process.

- **Cloud:** IoT generates a IoT of data and cloud platform allows us to store and process the IoT data received.

- **User Interface:** IoT provides a visible interface that can be easily accessed and controlled by the user.

2.5 Working of IoT

An IoT ecosystem consists of web-enabled smart devices that use embedded systems, such as processors, sensors and communication hardware, to collect, send and act on data they acquire from their environments. IoT devices share the sensor data they collect by connecting to an IoT gateway or other edge device where data is either sent to the cloud to be analyzed or analyzed locally. Sometimes, these devices communicate with other related devices and act on the information they get from one another.
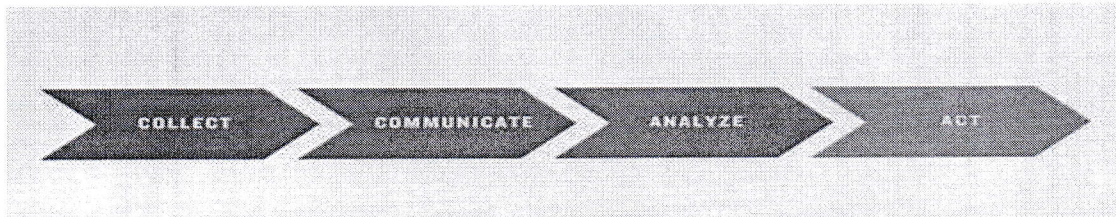
Figure 2.5 Working of IoT

An IoT system is comprised of connected devices that are frequently sending data about their status and environment around them.

- **Collect:** The life cycle of IoT starts with collecting data from different sources deployed in a particular region. These sources could be any sensors or device capable of transmitting data connected to a gateway. Data are efficiently collected and passed forward through a communication channel for analysis

- **Communicate:** This phase involves secure and reliable transfer of data. Routers, switches and firewall technologies play a vital role in establishing communication between devices. The Data is sent to the cloud or other data centres using the internet which is our major means of communication in IoT.

- **Analysis:** This phase is an important part of the IoT lifecycle. In this phase data collected from different sensor devices are collected and analysed based on the use case to extract some useful output/information.

- **Action:** This is the final stage of IoT lifecycle. Information obtained by the analysis of sensor data is acted upon and proper actions and measures are taken based on the analysis result.

Chapter 3

TASK PERFORMED

3.1 Problem Statement

Design an ECG monitoring system using IoT to provide real-time monitoring of patients' heart rate and detect abnormalities in the ECG waveform. The system should be able to capture and transmit ECG data wirelessly to a cloud-based platform for remote monitoring by healthcare professionals.

3.2 Steps involved in solving the problem statement

1. Hardware Selection: Select the appropriate ECG sensor module to capture the ECG waveform data. The selection of sensors and components should be done based on factors such as accuracy, cost, and compatibility with the IoT platform.

2. Data Acquisition: Connect the ECG sensor module to a microcontroller or single-board computer that can capture the ECG waveform data. Use the appropriate communication protocol such as SPI or 12C to communicate with the sensor module.

3. Cloud-based Platform: Use an IoT platform like Ubidots to store the ECG waveform data in the cloud. Ubidots has a user-friendly interface that allows for easy data visualization and analysis.

4. Cloud Integration: Integrate the microcontroller or single-board computer with the cloud-based platform to enable data transmission to the Ubidots server. This can be achieved using protocols such as MQTT or HTTP.

Chapter 4

METHODOLOGY

4.1 BLOCK DIAGRAM

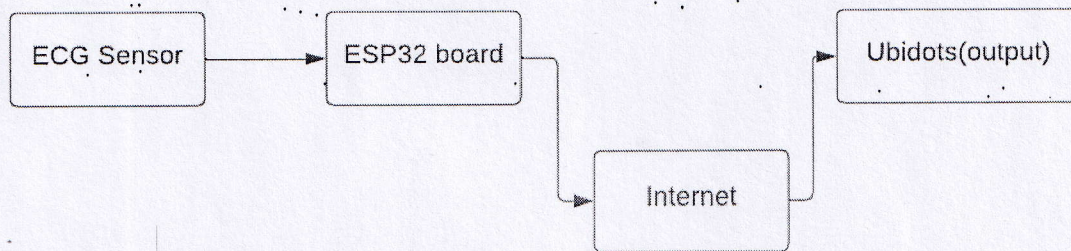The block diagram of ECG monitoring system is shown in the figure 4.1.

Figure 4.1 Block Diagram of ECG monitoring system

The ECG sensor is connected to the ESP32 microcontroller, which reads the ECG signal and sends it over the internet to the Ubidots cloud platform. The ESP32 is connected to the internet using a Wi-Fi.

The Ubidots platform receives the ECG data and stores it in the cloud. Users can access this data and visualize it on a dashboard using the Ubidots web interface.

4.2 CIRCUIT DIAGRAM

The circuit diagram of ECG monitoring system is shown in the figure 4.2.
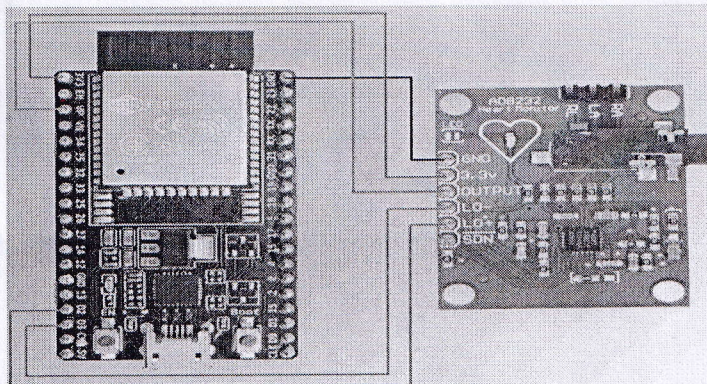
Figure 4.2 Circuit Diagram of ECG monitoring system

An ECG sensor typically has several pins that need to be connected to the ESP32 microcontroller in order to read the ECG signal and they are:

- ECG Signal Output Pin: This pin is used to output the ECG signal from the sensor. It needs to be connected to an analog input pin on the ESP32, such as VP pin.

- Ground Pin: This pin is used to connect the ECG sensor to ground. It needs to be connected to a ground pin on the ESP32, such as GND.

- +3.3V Power Pin: This pin is used to provide power to the ECG sensor. It needs to be connected to the +33V pin on the ESP32, such as 3V3.

- LO- and LO+ Pin: This pin is used to check whether a sensor is connected or not. They should be connected to digital input pins, such as D2 and D3.

Once the ECG sensor is connected to the ESP32, the microcontroller can read the ECG signal from the sensor by configuring an analog input pin and using it to sample the voltage output from the ECG signal pin. The sampled voltage values can then be processed and transmitted to a cloud platform such as Ubidots for further analysis and visualization.

4.3 SETTING UP UBIDOTS PLATFORM

To publish the data to IoT Cloud, we need some IoT platform. So Ubidots is one such platform. Ubidots offers a platform for developers that enables them to easily capture sensor data and turn it into useful information.

Steps to set up Ubidots platform:

1. *Creating Ubidots Account.*

   Go to ubidots.com and create and account. Will get a trial period of 30 days.
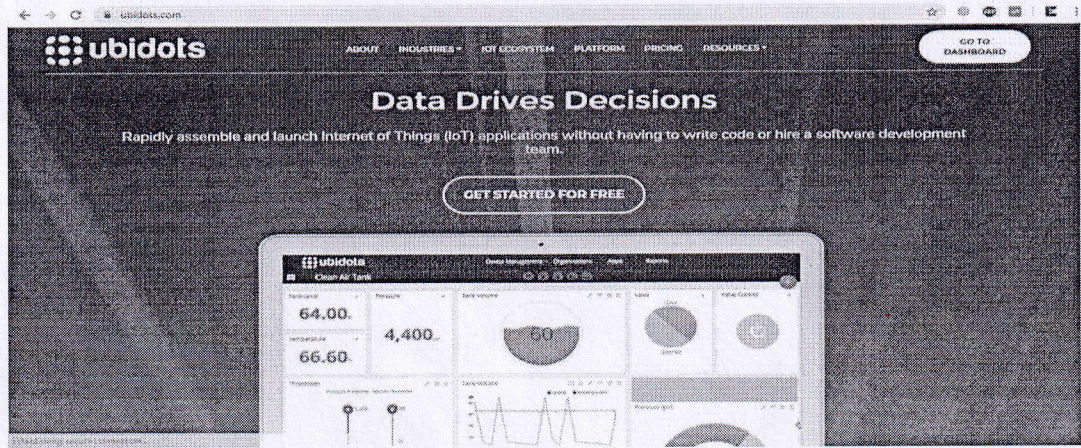
Figure 4.3.1 Webpage of Ubidots

2. *Creating Device & Adding Variables.*

Now setup an Ubidots Device. To create it, go to the Devices section (Devices > Devices). Create a new Device with name ECG_Monitoring_System.
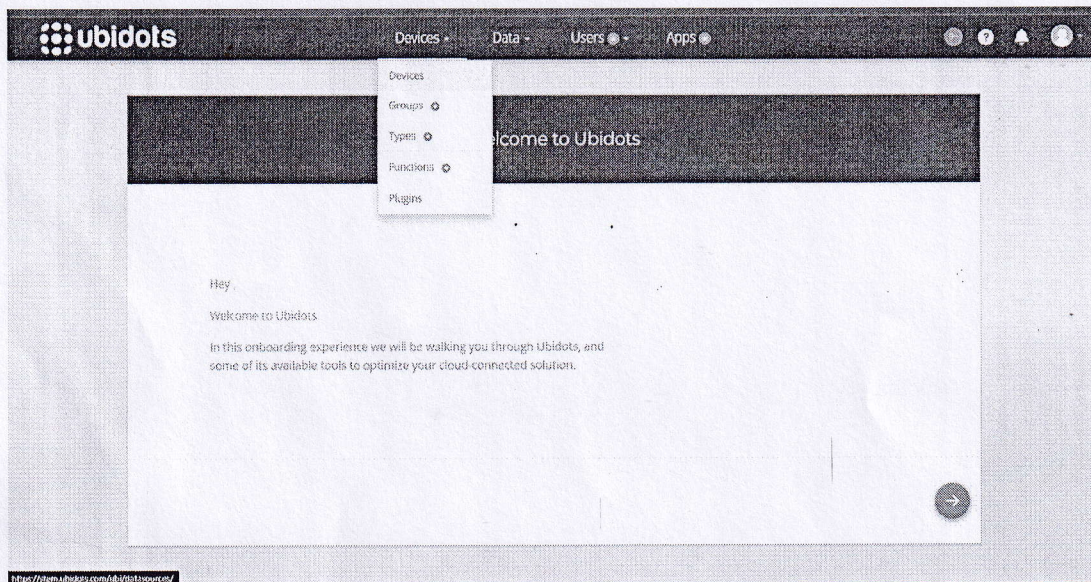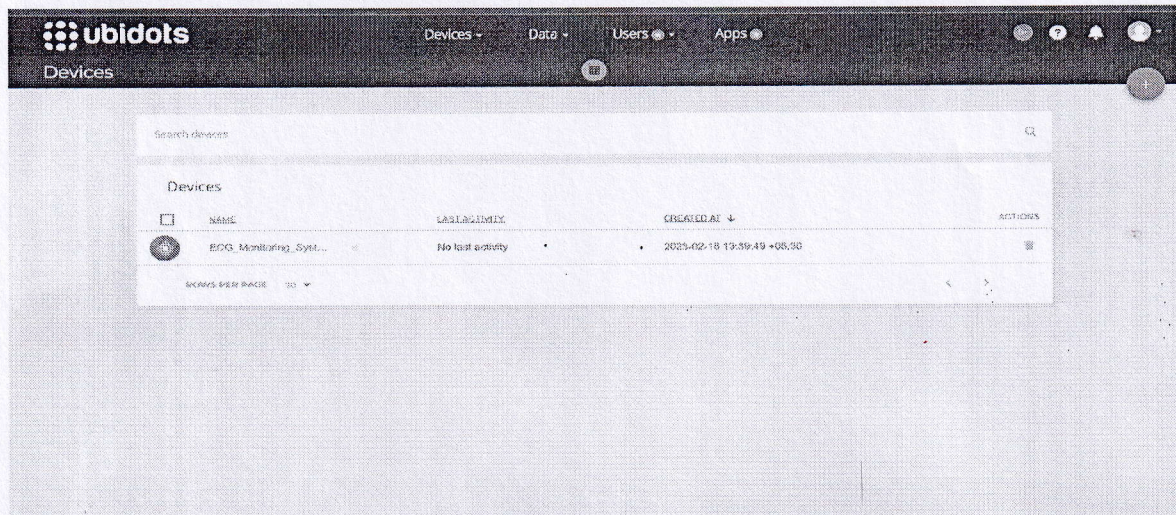

Figure 4.3.2 Selecting Devices section

Figure 4.3.3 Created device

Once the device is created, create a new variable by renaming the variabale to ECG_Data.

Figure 4.3.4 Creating variable
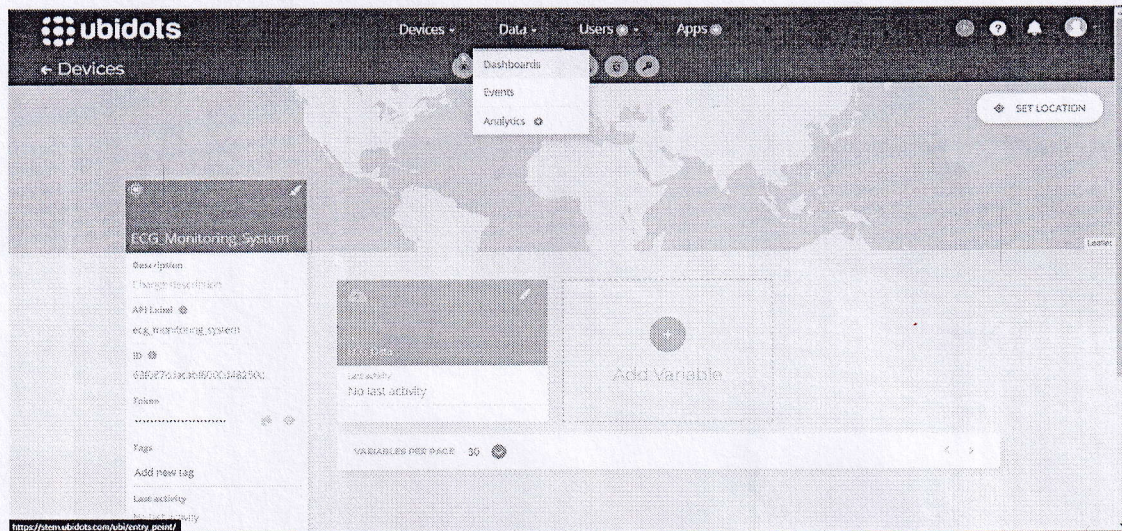
3. *Creating Dashboards.*

To create it, go to the Dashboard section (Data > Dashboard).

Figure 4.3.5 Creating dashboard

4. *Adding New Widgets.*

Click on the + sign in the right side and "Add new Widget", and select your widget.

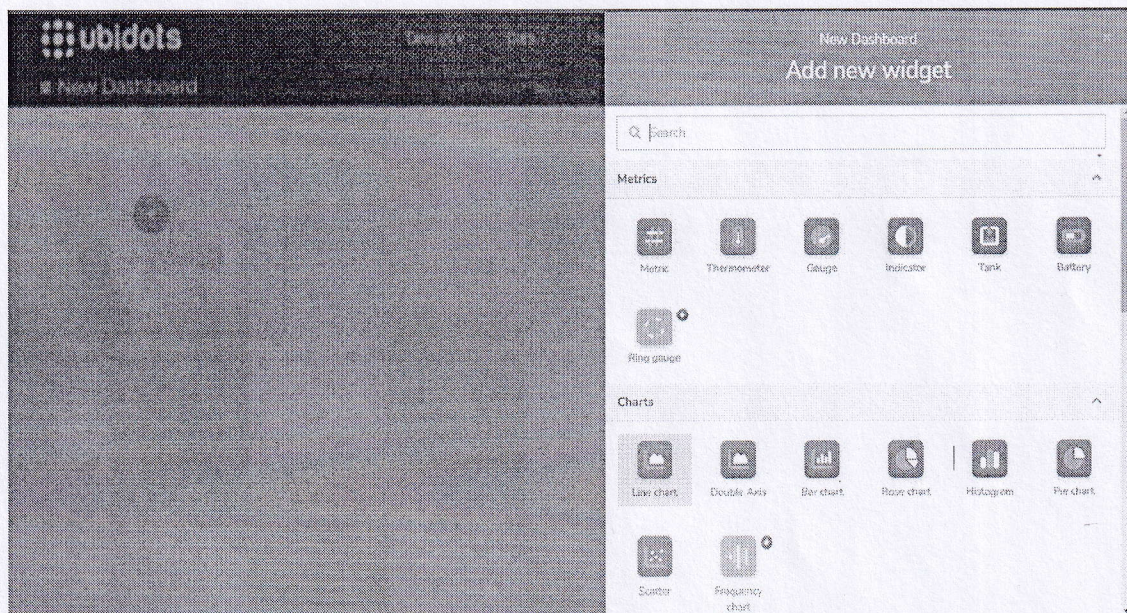Now, Select the type of widget desired to be displayed. In my case, I choose the "Line Chart":

Figure 4.3.6 Add new widget

Then, select the variable desired to display the data. Ubidots allows you assign a customize widget name, color, period of data to be displayed and much more. To finish the widget creation, press the green icon.
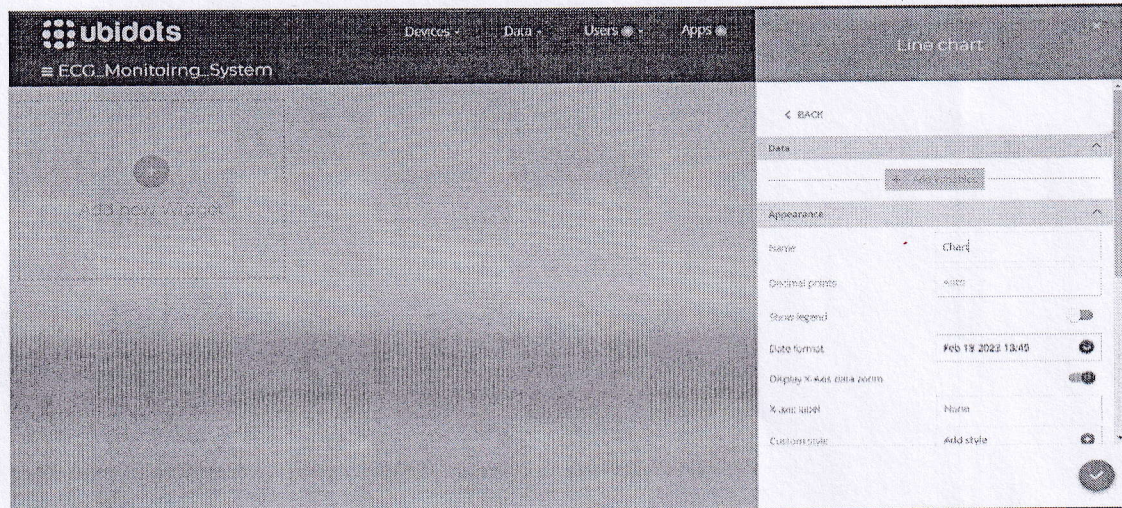

Figure 4.3.7 Setting widget settings

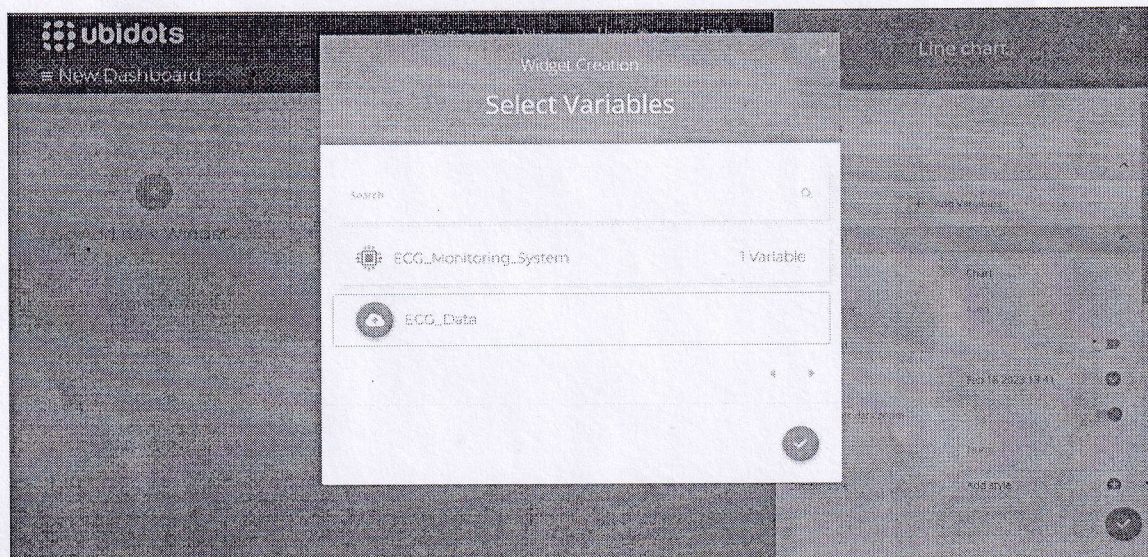Select your previously created Device and Variables as shown in the figure below.

Figure 4.3.8 Selecting variable

5. *Final Dashboard.*

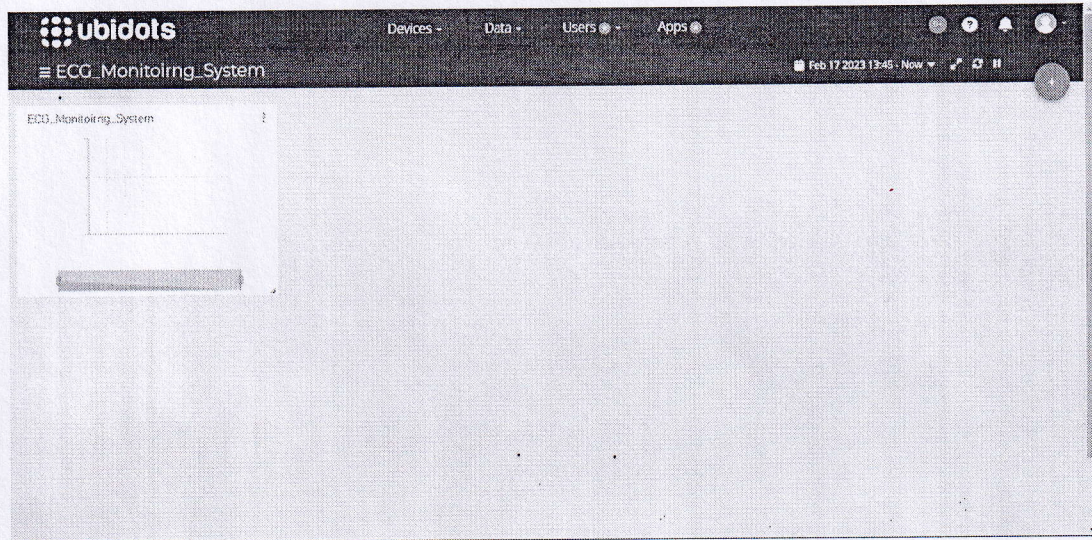The dashboard is created as shown in the figure 4.2.1 below.

Figure 4.3.9 Dashboard Created

Chapter 5

RESULTS
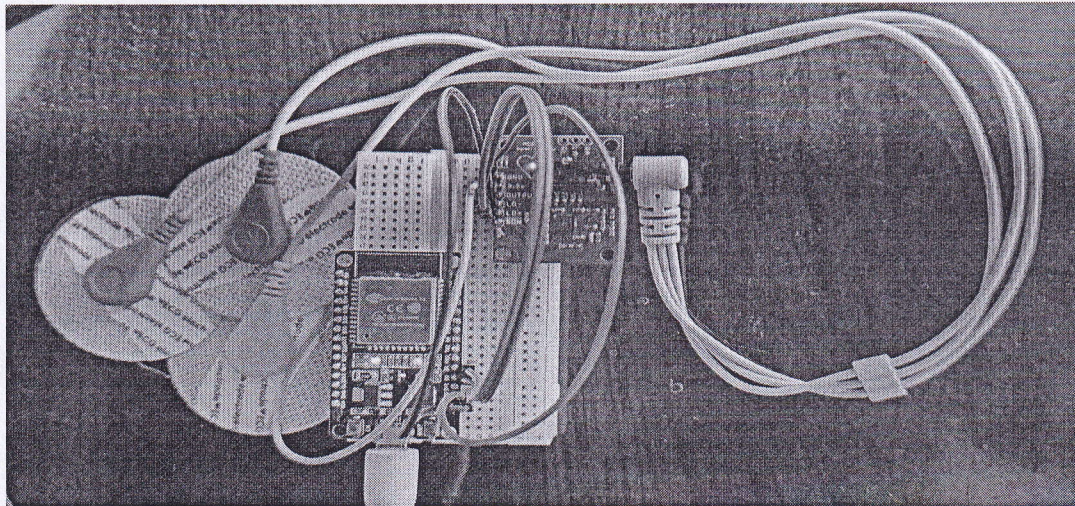
5.1 HARDWARE SETUP

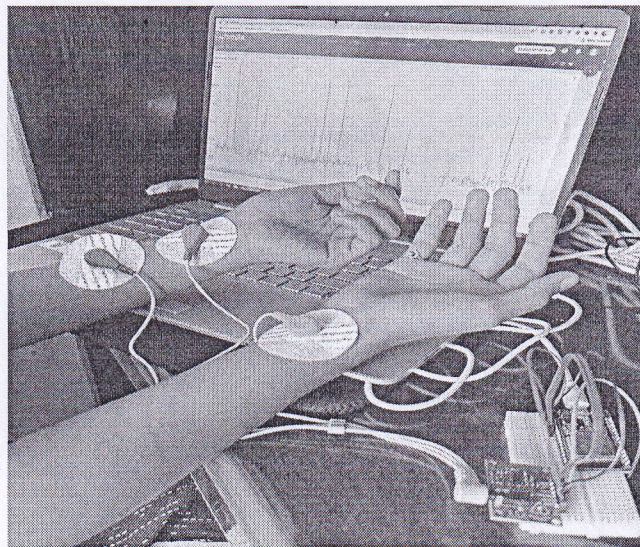The hardware setup is shown below:

Figure 5.1.1 Hardware setup

Figure 2.1.2 Hardware setup with output

5.2 OUTPUT

The output of the ECG Monitoring System is shown below:

Figure 5.2.1 Transferring data to Ubidots cloud

Figure 5.2.2 Displaying waveform in Ubidots

Chapter 6

CONCLUSION & FUTURE WORK

6.1 CONCLUSION

The ECG Monitoring System using Iot and Ubidots is a promising solution for remote patient monitoring. It offers several benefits, including real-time monitoring, early detection of abnormal heart rhythms, and timely intervention. The system's architecture and design are efficient, reliable, and easy to implement, making it suitable for use in various healthcare settings. The use of Ubidots as a cloud-based data management platform enables healthcare providers to visualize and analyse patient data in real-time, improving patient outcomes and reducing healthcare costs. Overall, the ECG Monitoring System using IoT and Ubidots is an excellent example of how technology can be used to enhance healthcare delivery and improve patient outcomes. Further research and development in this field could lead to even more advanced remote monitoring systems that can revolutionize healthcare.

6.2 FUTURE WORK

- Integration with other healthcare systems.
- Enhanced analytics and machine learning.
- Mobile application development.
- Improving user experience.
- Integration with wearables and other IoT devices.

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