A Project Stage-II Report on

ARTIFICIAL NEURAL NETWORK MODEL FOR CLASSIFICATION OF IOT DEVICE STATES IN MEDICAL INDUSTRY

Submitted in partial fulfilment of the requirements
for the award of the degree of

BACHELOR OF TECHNOLOGY

IN

COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)

By

C ARYA ABHIRVEY	**(21UJ1A6706)**
A VEDASRI	**(21UJ1A6702)**
R GOKUL VARMA	**(21UJ1A6722)**
Y HARI CHARAN	**(21UJ1A6742)**

Under the esteemed guidance of

Mr. SAYYED PASHA MOHAMMAD M.Tech.

Assistant Professor

Department of Computer Science and Engineering (Data Science)

At

MALLA REDDY ENGINEERING COLLEGE AND MANAGEMENT SCIENCES

Kistapur (V), Medchal (M), Medchal Malkajgiri (Dist)-501401.
(An UGC autonomous Institution, NBA Accredited in CSE, ECE, IT, EEE)

2021-2025

Affiliated to

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
KUKATPALLY, HYDERABAD-85.**

MALLA REDDY ENGINEERING COLLEGE AND MANAGEMENT SCIENCES

Kistapur (V), Medchal (M), Medchal Malkajgiri (Dist)-501401.

(An UGC autonomous Institution, NBA Accredited in **CSE, ECE, IT, EEE**)

CERTIFICATE

This is to certify that the Project Stage-II report entitled "**ARTIFICIAL NEURAL NETWORK MODEL FOR CLASSIFICATION OF IOT DEVICE STATES IN MEDICAL INDUSTRY** "is the bonafide work carried out and submitted by

C ARYA ABHIRVEY   (21UJ1A6706)
A VEDASRI   (21UJ1A6702)
R GOKUL VARMA   (21UJ1A6722)
Y HARI CHARAN   (21UJ1A6742)

To the department of **Computer Science and Engineering (Data Science), Malla Reddy Engineering College and Management Sciences**, in partial fulfilment for the award of **BACHELOR OF TECHNOLOGY IN COMPUTER SCIENCE AND ENGINEERING (DATA SCIENCE)** during the academic year 2024-2025.

Internal Guide   **Head of The Department**
Mr. SAYYED PASHA MOHAMMAD M.Tech.   **Dr.Zaheer Sultana** M.Tech, PhD.
Assistant Professor   Assistant Professor
Dept .of CSE (Data Science)   Dept .of CSE (Data Science)

EXTERNAL

ACKNOWLEDGEMENT

The satisfaction and euphoria that accompany the successful completion of any task would be incomplete without the mention of people who made it possible, whose constant guidance and encouragement crowned our efforts with success. It is a pleasant aspect that we have now the opportunity to express my guidance for all of them.

We are thankful to **Mr.V.MALLA REDDY** chairman of Malla Reddy Engineering College and Management Sciences for accepting ours and providing us with an opportunity to do a project in their esteemed organization.

We are thankful to Principal **Dr.M.SREEDHAR REDDY** M.Tech., Ph.D. Malla Reddy Engineering College and Management Sciences for helped ours to undergo project work as a part of university curriculum.

Our special thanks to **Dr. ZAHEER SULTANA** M.Tech,PhD.. Assistant Professor& Head in Computer Science and Engineering (Data Science) Department and **Mr. SAYYED PASHA MOHAMMAD** M.Tech. Assistant Professor in Computer Science and Engineering (Data Science) Department for guiding us in the right way to complete our project in the right time.

We would like to thank our internal project mates and department faculties for their full-fledged guidance and giving courage to carry out the project.

We are very much thankful to one and all that helped us for the successful completion of our project.

`

<div align="right">

C ARYA ABHIRVEY   (21UJ1A6706)
A VEDASRI   (21UJ1A6702)
R GOKUL VARMA   (21UJ1A6722)
Y HARI CHARAN   (21UJ1A6742)

</div>

LIST OF CONTENT

ABSTRACT

The widespread adoption of Internet of Things (IoT) devices in healthcare has underscored the need for intelligent systems to accurately classify device operational states. With over 60% of hospitals utilizing IoT for patient monitoring and the global medical IoT market projected to reach USD 254.2 billion by 2026, ensuring device reliability is critical. However, studies indicate that approximately 15% of medical IoT devices suffer from undetected malfunctions due to inefficient classification systems. Traditional manual monitoring methods are prone to errors, cannot handle large-scale real-time data, and often miss transient faults that can compromise patient safety and disrupt hospital operations. This study introduces a hybrid classification framework that combines an Artificial Neural Network (ANN) with an Extra Trees Classifier (ETC) to classify device states as either Normal or Anomaly. Data is sourced from hospital telemetry logs and the open-source Medical IoT Device Dataset (MIDD), undergoing preprocessing steps including null value removal, min-max normalization, and time-series segmentation. A baseline Gaussian Naïve Bayes Classifier (NBC) demonstrated moderate accuracy but failed to capture nonlinear relationships. In contrast, the ANN enables deep temporal feature extraction, and ETC ensures robust and efficient classification. The ANN with ETC model significantly outperforms traditional approaches in accuracy and anomaly detection, offering a reliable solution for real-time medical IoT monitoring.

Keywords:

Artificial Neural Network, Extra Trees Classifier, IoT device classification, medical IoT, healthcare technology, anomaly detection, device state monitoring, machine learning in healthcare, hybrid model, real-time telemetry, data preprocessing, intelligent healthcare systems, fault detection, time-series analysis, MIDD dataset, automated device status identification, neural network classifier, predictive maintenance, patient safety systems.

LIST OF FIGURES

LIST OF TABLES

ABBREVATIONS

ANN   Artificial Neural Network

SVM   Support Vector Machine

KNN   K-Nearest Neighbors

XNN   Extreme Neural Network

CSTM   Customized State Transition Model

IDS   Intrusion Detection System

HDC   Hyper dimensional Computing

DT   Decision Tree

RF   Random Forest

MLP   Multi-Layer Perceptron

CNN   Convolutional Neural Network

IOT-MED   Internet of Things in Medical Applications

MDCS   Medical Device Classification System

NB   Naive Bayes

LR   Logistic Regression