**RV College of Engineering®, Bengaluru – 59**
**Department of Artificial Intelligence and Machine**
**Big Data Technologies (AI3621A)**

# Synopsis

| **TITLE : Fault Detection in Electronic Circuit Boards using Big Data Analytics** | | |
|---|---|---|
| **TEAM** | USN: 1RV23AI403 | Name:Omkar BM |
| | USN:1RV23AI405 | Name:Sabaasultana Namaji |
| | USN:1RV22AI045 | Name:Rishikesh K |

## 1. Introduction

This project aims to develop a real-time fault detection and monitoring system for electronic circuit boards using Big Data technologies. Modern electronic systems, especially those used in consumer electronics and industrial environments, can degrade due to thermal, voltage, or component faults. Traditional inspection methods are inefficient at scale and lack real-time insights.This system intends to use simulated sensor data to detect anomalies using distributed data processing tools like Hadoop MapReduce and Apache Spark, enabling predictive maintenance and improved reliability.

## 2. Existing System

Current fault-detection systems in electronics rely on manual testing, multimeters, or static simulation tools. They suffer from:

- Lack of real-time insights
- Inability to handle large-scale sensor data
- No predictive capabilities for future faults
- These limitations lead to delayed fault identification, increased downtime, and poor component lifecycle tracking.

## 3. Proposed System

The proposed solution will:

- Collect and simulate real-time sensor data (voltage, current, temperature, etc.)
- Perform preprocessing using Hadoop MapReduce
- Analyze and detect anomalies using Apache Spark
- Visualize trends and faults using Python (Matplotlib/Seaborn) or Power BI

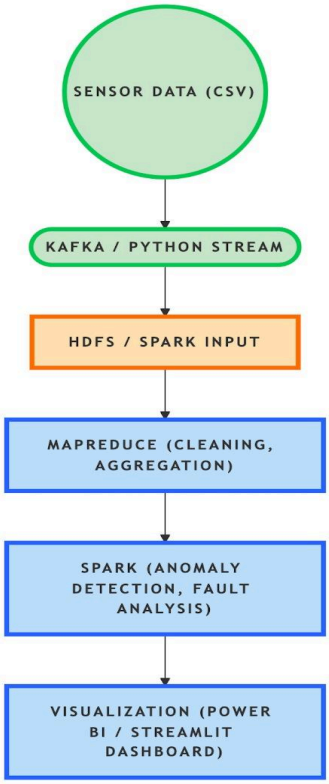
Present results through a graphical user interface (Phase II) The system will be developed using Python for data generation and streaming, Apache Spark for distributed analysis, and simple GUI tools like Streamlit or Flask for visualization.

## 4. Big Data Technology Stack

- Data Source: Simulated circuit board data (10,000+ records)
- MapReduce: Preprocessing (average, max, fault count)
- Apache Spark: Fault trend analysis, anomaly detection
- Storage: HDFS/local file system
- Visualization: Matplotlib, Seaborn, or Power BI
- GUI: Streamlit or Flask for final output display
- Optional Integration: Kafka for real-time streaming simulation

## 5. Statistics

- Over 35% of circuit board failures are due to thermal or electrical anomalies (Source: IPC, 2023)
- 60% of electronic faults could be prevented with real-time monitoring and predictive analytics
- A single smart PCB can generate 10,000+ sensor readings per hour under full load
- Traditional testing can take up to 10× longer than automated real-time systems
- Predictive fault detection improves electronic component lifespan by up to 30%
- Real-time big data tools like Spark can process GBs of sensor data in seconds, enabling immediate alerting and decision-making




**Streaming Architecture for Fault Detection in Electronic Systems**

## 6. Societal Concern

Electronics are part of daily life—phones, appliances, vehicles, and medical devices.

This project contributes by:

- Reducing electronic failures through early detection
- Enabling predictive maintenance and energy savings
- Empowering electronics manufacturers to optimize design and maintenance