PROJECT PROPOSAL FOR JAMES M JANA

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

PROJECT PROPOSAL

BASE STATION MONITORING SYSTEM

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1.0 Introduction

Base stations require frequent maintenance as this is where radio repeaters are situated. Radio repeaters allow wide coverage of network even in remote areas. And for that reason some base stations need to be located at complete remote areas which are sometimes difficult to reach effortlessly. Technicians are not able to reach out to remote area based base stations at any given times. And in most cases the stations get to be visited for maintenance only if a fault has incurred.

This can be of great inconvenience especially for a critical field like telecommunication, and can even be catastrophic in instances where communication is more crucial for example railway management systems communication. Failure to receive or transmit signal could lead to undesirable consequences taking place. Network providers would also pose a risk of losing their clientele due to continuous network disruptions.

So it is very important to implement preventive maintenance at base stations, hence a monitoring system would play a huge role in enabling that.

Base repeater station monitoring system would help in monitoring the critical equipment of base stations as well as monitor environmental surroundings.This system will also make it convenient for the technicians to know exactly what they have to attend to whenever they get to visit the base stations for maintenance.

This system will consist of a network of sensors which include temperature sensor to monitor any temperature anomalies in case of air conditioner failure, fuel level sensor for the powering generator, battery level sensor for backup power system, and most importantly the system aims to monitor the transmission signal strength .The system will consist of a real-time dashboard which shows current status of each of these parameters at the base station.

The system will not only monitor the equipment but also aims to predict remaining life span of the base station equipment through the implementation of machine learning technology. This will be of great assistance for future financial planning because of the high cost required to set up and / or replace these equipment.

 This project will implement smart technology such as Internet of Things(IoT), machine learning(ML) in the field of telecommunications. IoT is used for connecting the electronic devices with the internet.[1] The twenty-first century has witnessed a massive paradigm shift

to and focusing on global attention onto IoT as a burgeoning discipline with multiple possibilities and diverse opportunities for growth and development [2].

1.1 Background

Network providers require base stations to increase their network coverage . These base stations consists of critical infrastructure such as base repeaters, generators UPS systems. All these require optimum conditions to function continuously and efficiently so as to provide quality network services and customer satisfaction. However all this infrastructure is susceptible to unexpected disruptions hence unexpected signal transmission failure. Most operators especially in developing countries like Zimbabwe, currently implement reactive maintenance and this tend to increase unexpected downtime. All this results in a declined service quality, increasing the number of complaints from customers due to customers dissatisfaction . The more customers lost the less revenue coming in, and this can lead to company closure, not to mention job losses.

1.2 Aim & Objectives

AIM

To design and develop a base station monitoring system that will keep track of the base station equipment, providing the technicians with real time status of each equipment and determine the remaining life span of the equipment.

OBJECTIVES

1. Build an IoT based base station monitor to monitor temperature, generator fuel level, ups battery level, repeater signal strength.

2. Build a dashboard/web application for remote monitoring.

3. Store maintenance history of the base station equipment on a database.

4. Implement machine learning algorithm to determine remaining life span of the base station equipment.

5. Integrate the whole system of sensors, machine learning ,dashboard so that they function as a single unit.

1.3 Justification

Failure to maintain base station at the right time may result in increased service disruptions, not to mention higher maintenance costs due to undesirable conditions such as overheating. This can damage base station infrastructure leading to signal transmission failure hence compromising quality service of network providers. This project aims to use IoT technology to remotely monitor the base stations in real time optimizing network performance at all times thus customer satisfaction.This project attempts to detect faults early thus reducing or avoiding any chances of transmission failure. As it is now the communication system has become highly competitive with the likes of gigantic companies like Starlink penetrating into the global market. This calls for modernisation of systems so as to maintain highly competitive and deliver best quality service to clients.

For companies where resources are limited ,this system will help in efficient resource allocation as this will reduce unnecessary site visits costs especially for remotely situated base stations.

1.4 Project methodology

The system will be broken down into the following components:

- IoT monitor
- Web application
- Machine learning system
- Database

1) IoT monitoring system - use IoT sensors to monitor fuel temperature, as well as UPS battery level, generator fuel level and signal transmission strength.

2) Web application were the status of each of the above (1) mentioned parameters will be monitored

3) Machine learning- predict remaining life span of the base station equipment using maintenance history data and give a timeline on when the next maintenance needs to be done.

4) Database- to store data of service history of these equipment as well as status of the monitored equipment.

Below is the general overview of how the whole system will operate.
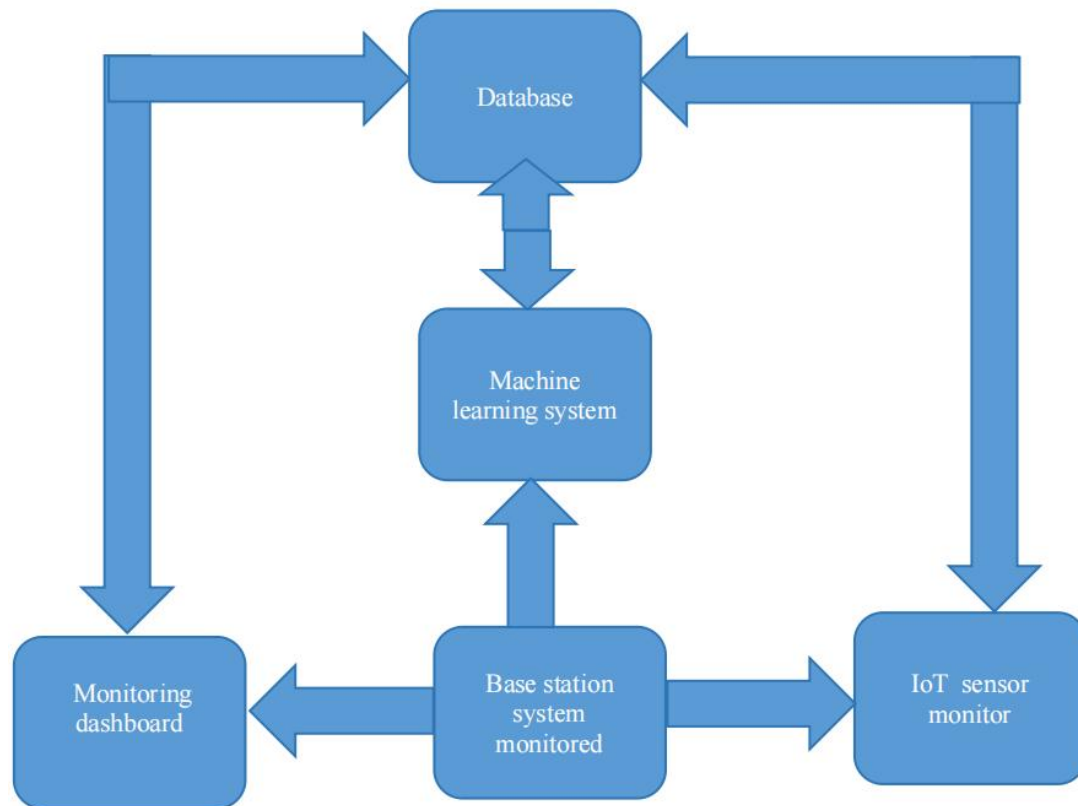

FIGURE 1 : SYSTEM OVERVIEW

1.5 Budget and timeline

1.5.1 Budget

Temperature sensor - US$ 10

Battery level sensor - US$ 10
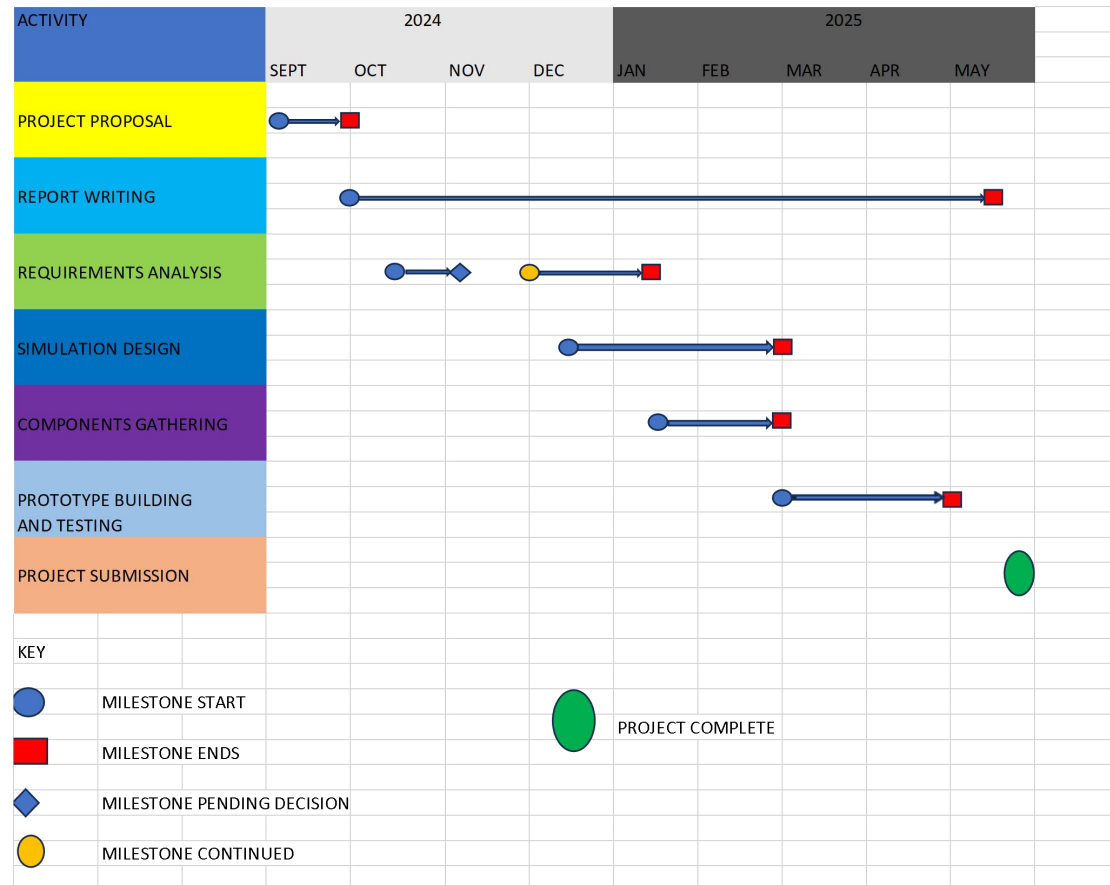
Signal strength tester - US$ 20

Fuel level sensor - US$ 8

Micro controller - US$ 50

ESTIMATED TOTAL COST = US$ 98

1.5.2 Time line

ACTIVITY			2024				2025					
		SEPT	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY		
PROJECT PROPOSAL		● → ■										
REPORT WRITING			● ———————————————————————— ■									
REQUIREMENTS ANALYSIS			● ◆	○ → ■								
SIMULATION DESIGN					● ————— ■						
COMPONENTS GATHERING						● —— ■					
PROTOTYPE BUILDING AND TESTING							● ———— ■				
PROJECT SUBMISSION									●		

KEY

●	MILESTONE START
■	MILESTONE ENDS
◆	MILESTONE PENDING DECISION
○	MILESTONE CONTINUED

● PROJECT COMPLETE

References

[1] Nabiryo Patience and Itodo Anthony Ejeh , "Design and Implementation of Base Station Temperature Monitoring System Using Raspberry Pi", IDOSR JOURNAL OF SCIENCE AND TECHNOLOGY 7(1):53-66, 2022.

[2] Satyanarayana, G. V. and Mazaruddin, S. D. (2013). Wireless Sensor Based Remote Monitoring System for Agriculture Using ZigBee and GPS Conference on Advances in Communication and Control Systems" (CAC2S 2013).