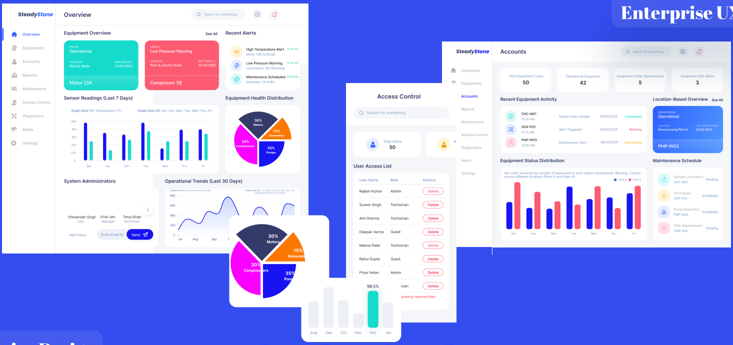
PREDICTIVE MAINTENANCE SYSTEM WITH AI & IOT

Enterprise UX


SteadyStone
Overview
Equipment Overview
Operational
Plant B, Noida
12/06/2025
Motor 12A
Low Pressure Warning
Plant A, Greater Noida
18/03/2025
Compressor 5B
Recent Alerts
High Temperature Alert
Low Pressure Warning
Maintenance Scheduled
Sensor Readings (Last 7 Days)
Equipment Health Distribution
30% Motors
15% Generators
20% Compressors
35% Pumps
System Administrators
Dhireender Singh CEO
Vinal Jain Manager
Tanuj Singh Technician
Add Users
Send
Operational Trends (Last 30 Days)
Access Control
Total Users 50
User Access List
Accounts
Total Equipment Count 50
Operational Equipment 42
Equipment Under Maintenance 5
Equipment with Alerts 3
Recent Equipment Activity
CNC-M01
GEN-P02
PMP-W03
Location-Based Overview
Manufacturing Plant A
PMP-W03
Equipment Status Distribution
Maintenance Schedule
98.5%
Aug
Sep
Oct
Nov
Dec
Jan

User Name	Role	Actions
Rajesh Kumar	Admin	Delete
Suresh Singh	Technician	Delete
Anil Sharma	Technician	Delete
Deepak Verma	Guest	Delete
Meena Patel	Technician	Delete
Rahul Gupta	Guest	Delete
Priya Yadav	Admin	Delete

Responsive Design

Project Overview

To design and implement a predictive maintenance system that leverages IoT sensors and AI algorithms to monitor construction equipment and infrastructure in real-time, predict maintenance needs, and minimize downtime

The problem statement

Predictive Maintenance (PdM) is a proactive strategy that uses data analysis and machine learning to anticipate equipment failures, enabling organizations to schedule maintenance and optimize operational efficiency. By adopting PdM, organizations can reduce maintenance costs by up to 30%, decrease equipment downtime by up to 45%, and extend equipment lifespan by up to 20%. The integration of IoT and AI is key to PdM's effectiveness, providing real-time data and analytical intelligence to transform raw data into actionable insights and enable accurate maintenance predictions.

Project Goals

Minimize equipment downtime by predicting failures using AI insights.

Enhance operational efficiency through real-time IoT-based equipment monitoring.

Improve maintenance planning with data-driven alerts and performance reports.

User problems

- Unexpected equipment failures cause costly delays and project downtime.
- Manual inspections are time-consuming and often miss early issues.
- Lack of real-time data hampers quick decision-making on-site.
- Maintenance schedules are generic, not based on actual usage.
- No alerts for critical equipment health or performance drops.
- Inconsistent reporting leads to poor maintenance planning and tracking.

Possible Solutions

Based on all the information collected through research and findings, I concluded that an application will require the following functionalities to enable predictive maintenance on construction sites

Monitor equipment in real-time using IoT sensor data.

Predict failures early through AI-based data analysis models.

Trigger instant alerts for anomalies and performance deviations.

Maintain detailed logs of equipment health and maintenance history.

Automate and reschedule tasks based on predictive maintenance insights.

Display visual dashboards for equipment status and risk levels.

Motivate staff with gamification for better equipment care.

Understanding the Problem

Before touching anything related to design, I wanted to understand the effects of sedentary lifestyle on employees due to work from home condition.

A 2017 paper by the Sedentary Behavior Research Network (SBRN) defined sedentary behavior as any activity involving sitting, reclining, or lying down that has a very low energy expenditure.

Methodology

Research
1

2
Brainstorming

Ideation
3

4
Feedback & Iteratoin

Prototyping
5

Secondary Research

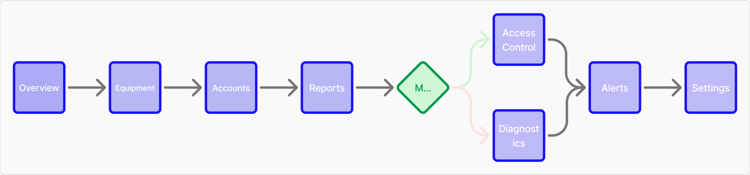
IoT (Internet of Things) in Predictive Maintenance for Construction Sites

Introduction to IoT in Predictive Maintenance: The Internet of Things (IoT) refers to a network of interconnected devices that collect, exchange, and analyze data to enable smarter decision-making. In the context of predictive maintenance for construction sites, IoT plays a critical role in monitoring equipment and infrastructure health, identifying potential issues before they lead to failures, and optimizing maintenance schedules.:

Key Components of IoT in Predictive Maintenance: IoT Sensors Types:

1. **Vibration Sensors**: Detect abnormal vibrations indicating mechanical issues.
2. **Temperature Sensors:** Monitor overheating in machinery components.
3. **Pressure Sensors**: Measure fluid or air pressure in hydraulic and pneumatic systems.
4. **Proximity Sensors**: Track the movement and position of equipment.
5. **Wear Sensors**: Detect wear and tear on parts like belts and bearings

User Flow


Overview
Equipment
Accounts
Reports
M...
Access Control
Diagnostics
Alerts
Settings

User Personas

Name: Vikram patel
Gender: Male
Age:30+

Bio

Vikram Patel is a seasoned equipment operator with over 15 years of experience in managing and operating heavy construction machinery, including excavators, bulldozers, and cranes. Known for his precision, safety-first mindset, and technical know-how, Vikram has worked on large-scale infrastructure projects across India, including highways, bridges, and industrial complexes.With a keen eye for maintenance and troubleshooting, he ensures optimal machine performance and minimal downtime.

Pain Points

- Uncertainty about the condition of older equipment.
- Concerns about personal safety due to unexpected equipment malfunctions
- Difficulty in conveying technical issues to the maintenance team.
- Lack of real-time machine diagnostics

Goals

- Operate machinery without interruptions and ensure personal safety.
- Easily report equipment issues and receive timely responses.
- Minimize downtime caused by equipment failure

Name:Suresh Menon
Gender: men
Age:20+

Bio

Suresh Menon is a results-driven Operations Director with two decades of experience in streamlining large-scale operations, managing cross-functional teams, and implementing systems that enhance efficiency and performance. Known for his leadership skills and data-driven approach, Suresh oversees daily operations, resource allocation, vendor management, compliance, and team productivity.

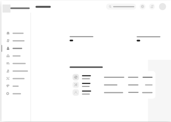
Pain Points

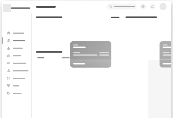
- Inconsistent maintenance practices across different sites
- Lack of real-time visibility into equipment performance
- Challenges in scaling maintenance best practices across diverse geographical locations.
- Inefficient manual processes that delay decision-making
- Challenges in workforce and equipment coordination

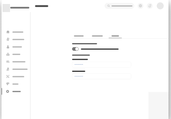
Goals

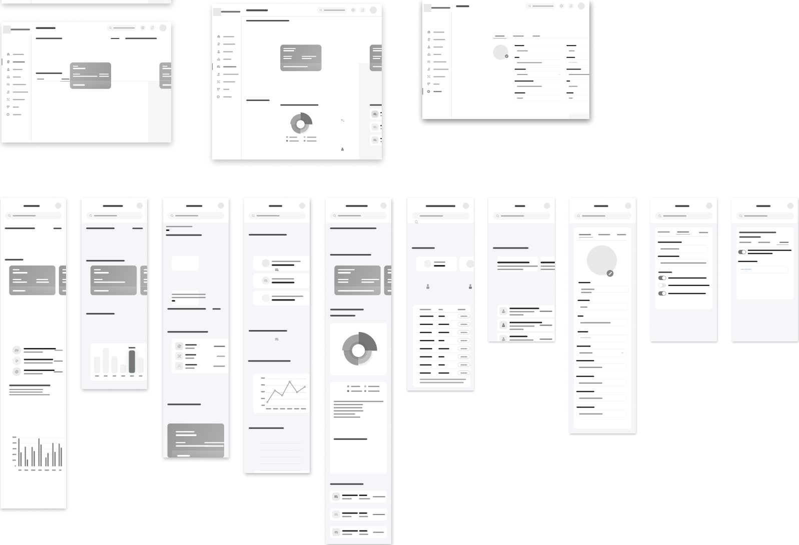
- Monitor multiple sites and ensure optimal resource utilization
- Receive consolidated reports on equipment health and maintenance status
- Reduce operational costs and improve efficiency across projects.

Wireframes



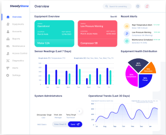


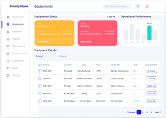


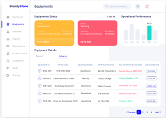


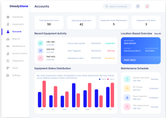
Early Sketches & Ideations

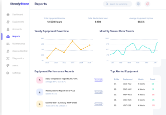
Hi-fi designs

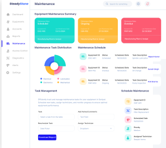

SteadyStone
Overview
Overview
Equipments
Accounts
Reports
Maintenance
Access Control
Diagnostics
Alerts
Settings
Equipment Overview
See All
Operational
Motor 12A
Low Pressure Warning
Compressor 5B
Recent Alerts
High Temperature Alert
Low Pressure Warning
Maintenance Scheduled
Sensor Readings (Last 7 Days)
Equipment Health Distribution
System Administrators
Operational Trends (Last 30 Days)
Send

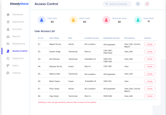

SteadyStone
Equipments
Equipments Status
See All
Operational Performance
Equipment Details
General
Advance

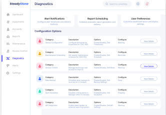

SteadyStone
Equipments
Equipments Status
See All
Operational Performance
Equipment Details
General
Advance

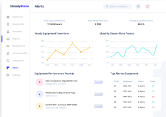

SteadyStone
Accounts
Recent Equipment Activity
Location-Based Overview
See All
Equipment Status Distribution
Maintenance Schedule

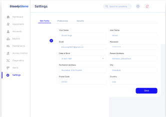

SteadyStone
Reports

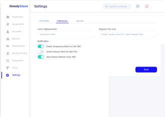

SteadyStone
Maintenance

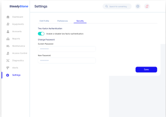

SteadyStone
Access Control

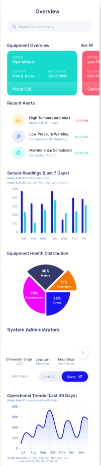

SteadyStone
Diagnostics


SteadyStone
Alerts


SteadyStone
Settings


SteadyStone
Settings


SteadyStone
Settings


Overview
Search for something
Equipment Overview
See All
STATUS
Operational
LOCATION
Plant B, Noida
NEXT SERVICE
12/06/2025
Motor 12A
STATUS
Low P
LOCATION
GEN-PO
Compr
Recent Alerts
Sensor Readings (Last 7 Days)
500
400
300
200
100
0
Sat
Sun
Mon
Tue
Wed
Thu
Fri
Equipment Health Distribution
30% Motors
15% Generators
20% Compressors
35% Others
System Administrators
Add Users
Email ID
Send
Operational Trends (Last 30 Days)
800
600
400
200
0
Jul
Aug
Sep
Oct
Nov
Dec
Jan

High Temperature Alert
Motor 12B (Critical) 10:15 AM

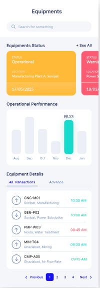
Low Pressure Warning
Compressor 5B (Warning) 10:00 AM

Maintenance Scheduled
Generator 1A (Info) 09:30 AM

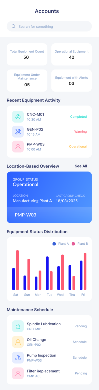
Graph Axis (Y): Temperature (°C)
Graph Axis (X): Sat, Sun, Mon, Tue, Wed, Thu, Fri

Dhireender Singh CEO
Vinai Jain Manager
Tanuj Singh Technician

Graph Axis (Y): Operational Health Index
Graph Axis (X): Jul, Aug, Sep, Oct, Nov, Dec, Jan (representing the last 30 days)


Equipments
Search for something
Equipments Status
+ See All
STATUS
Operational
LOCATION
Manufacturing Plant A, Sonipat
17/05/2025
STATUS
Warni
LOCATION
Power S
18/03/
Operational Performance
98.5%
Aug
Sep
Oct
Nov
Dec
Jan
Equipment Details
All Transactions
Advance
< Previous
1
2
3
4
Next >

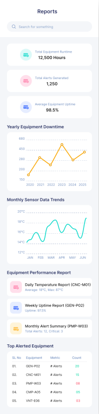
CNC-M01 Sonipat, Manufacturing 10:30 AM
GEN-P02 Sonipat, Power Substation 10:00 AM
PMP-W03 Noida, Water Treatment 09:45 AM
MIN-T04 Ghaziabad, Mining 09:30 AM
CMP-A05 Ghaziabad, Air Flow Rate 09:15 AM


Accounts
Search for something
Recent Equipment Activity
Location-Based Overview
See All
GROUP STATUS
Operational
LOCATION
Manufacturing Plant A
LAST GROUP CHECK
18/03/2025
PMP-W03
Equipment Status Distribution
Plant A
Plant B
Sat
Sun
Mon
Tue
Wed
Thu
Fri
Maintenance Schedule

Total Equipment Count 50
Operational Equipment 42
Equipment Under Maintenance 05
Equipment with Alerts 03

CNC-M01 10:30 AM Completed
GEN-P02 10:15 AM Warning
PMP-W03 10:00 AM Operational

Spindle Lubrication CNC-M01 Pending
Oil Change GEN-P02 Schedule
Pump Inspection PMP-W03 Schedule
Filter Replacement CMP-A05 Pending


Reports
Search for something
Yearly Equipment Downtime
680
450
280
200
150
2020
2021
2022
2023
2024
2025
Monthly Sensor Data Trends
20°C
18°C
16°C
14°C
12°C
JAN
FEB
MAR
APR
MAY
JUN
Equipment Performance Report
Top Alerted Equipment

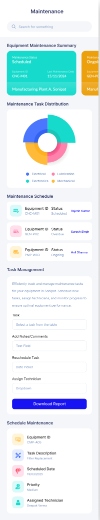
Total Equipment Runtime 12,500 Hours
Total Alerts Generated 1,250
Average Equipment Uptime 98.5%

Daily Temperature Report (CNC-M01)
Average: 18°C, Max: 87°C

Weekly Uptime Report (GEN-P02)
Uptime: 97.5%

Monthly Alert Summary (PMP-W03)
Total Alerts: 12, Critical: 3

SL No	Equipment	Metric	Count
01.	GEN-P02	# Alerts	20
02.	CNC-M01	# Alerts	15
03.	PMP-W03	# Alerts	08
04.	CMP-A05	# Alerts	05
05.	VNT-E06	# Alerts	03

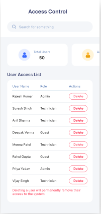

Maintenance
Search for something
Equipment Maintenance Summary
Maintenance Status
Scheduled
Equipment ID
CNC-M01
Last Maintenance Date
15/11/2024
Manufacturing Plant A, Sonipat
Mainten
Ongoi
Equipmen
GEN-P
Manuf
Maintenance Task Distribution
Electrical
Lubrication
Electronics
Mechanical
Maintenance Schedule
Task Management
Download Report
Schedule Maintenance

Equipment ID CNC-M01 Status Scheduled Rajesh Kumar
Equipment ID GEN-P02 Status Overdue Suresh Singh
Equipment ID PMP-W03 Status Ongoing Anil Sharma

Efficiently track and manage maintenance tasks for your equipment in Sonipat. Schedule new tasks, assign technicians, and monitor progress to ensure optimal equipment performance.

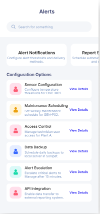
Task: Select a task from the table
Add Notes/Comments: Text Field
Reschedule Task: Date Picker
Assign Technician: Dropdown

Equipment ID: CMP-A05
Task Description: Filter Replacement
Scheduled Date: 18/03/2025
Priority: Medium
Assigned Technician: Deepak Verma


Access Control
Search for something
Total Users
50
User Access List

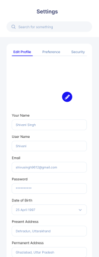
User Name	Role	Actions
Rajesh Kumar	Admin	Delete
Suresh Singh	Technician	Delete
Anil Sharma	Technician	Delete
Deepak Verma	Guest	Delete
Meena Patel	Technician	Delete
Rahul Gupta	Guest	Delete
Priya Yadav	Admin	Delete
Vijay Singh	Technician	Delete

Deleting a user will permanently remove their access to the system.

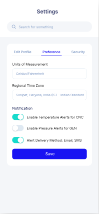

Alerts
Search for something
Report S
Configuration Options
View Details

Alert Notifications
Configure alert thresholds and delivery methods.

Sensor Configuration: Configure temperature thresholds for CNC-M01.
Maintenance Scheduling: Set weekly maintenance schedule for GEN-P02.
Access Control: Manage technician user access for Plant A.
Data Backup: Schedule daily backups to local server in Sonipat.
Alert Escalation: Escalate critical alerts to Manage after 15 minutes.
API Integration: Enable data transfer to external reporting system.

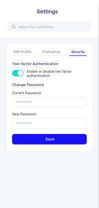

Settings
Search for something
Edit Profile
Preference
Security

Your Name: Shivani Singh
User Name: Shivani
Email: shivusingh9612@gmail.com
Password: **********
Date of Birth: 25 April 1997
Present Address: Dehradun, Uttarakhand
Permanent Address: Ghaziabad, Uttar Pradesh

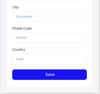

Settings
Search for something
Edit Profile
Preference
Security
Save

Units of Measurement: Celsius/Fahrenheit
Regional Time Zone: Sonipat, Haryana, India (IST - Indian Standard

Notification
Enable Temperature Alerts for CNC
Enable Pressure Alerts for GEN
Alert Delivery Method: Email, SMS


Settings
Search for something
Edit Profile
Preference
Security
Save

Two-factor Authentication
Enable or disable two factor authentication
Change Password
Current Password: **********
New Password: **********



City
Ghaziabad
Postal Code
201001
Country
India

Key Learnings

Working on this problem helped me widen my understanding of sedentary lifestyle and its ill-effects. Finding the right features that solved the users problem was challenging, but this project helped me get out of my comfort zone & challenge myself to deliver user centric solutions.

However, there are still a lot of inputs & features that could be added with proper testing and identifying the problem with the help of real-time user data.

Thank You For Watching

Designer
shivani singh