SOLAR-POWERED ENVIRONMENT AND VIBRATION MONITORING PROTOTYPE

BY INVICTUS TEAM 8

The silent decay of India's heritage

ACROSS INDIA, THOUSANDS OF HERITAGE STRUCTURES BUILT WITH TRADITIONAL LIME-SURKHI TECHNIQUES ARE SLOWLY DETERIORATING FROM INSIDE DUE TO TRAPPED MOISTURE, VIBRATION STRESS AND POOR RESTORATION METHODS. MODERN CEMENT-BASED REPAIRS BLOCK THE NATURAL BREATHABILITY OF LIME WALLS, CAUSING CRACKS, BULGING AND LONG-TERM STRUCTURAL WEAKENING. BECAUSE THE DECAY IS INVISIBLE IN THE EARLY STAGES, INTERVENTION HAPPENS ONLY AFTER VISIBLE DAMAGE APPEARS – WHEN IT IS ALREADY TOO LATE OR TOO COSTLY TO REPAIR. AT THE SAME TIME, TRADITIONAL ARTISANS AND INDIGENOUS CONSERVATION KNOWLEDGE ARE DISAPPEARING, CREATING A GAP BETWEEN HERITAGE VALUE AND PRESERVATION PRACTICE. AS A RESULT, INDIA IS FACING AN URGENT NEED FOR PREVENTIVE, SUSTAINABLE AND TECHNOLOGY-ASSISTED MONITORING, BEFORE HISTORIC STRUCTURES COLLAPSE OR ARE PERMANENTLY LOST."

Why Current Conservation Methods Fail”

- CEMENT-BASED REPAIRS TRAP MOISTURE INSTEAD OF RELEASING IT
- DAMAGE BECOMES VISIBLE ONLY AFTER IT IS TOO LATE
- NO REAL-TIME MONITORING → ONLY REACTIVE RESTORATION
- TRADITIONAL MASONS AND MATERIALS ARE DISAPPEARING
- EARLY DECAY REMAINS INVISIBLE → IRREVERSIBLE LOSS LATER

PROJECT GOALS

- TO SHIFT HERITAGE CONSERVATION FROM REACTIVE RESTORATION TO PROACTIVE, TECHNOLOGY-ENABLED EARLY PRESERVATION.”

- “TO REVIVE AND INTEGRATE INDIA’S INDIGENOUS LIME-BUILDING WISDOM FOR SUSTAINABLE AND ECO-FRIENDLY REPAIRS.”

How the System Works/Mechanism

- HUMIDITY AND VIBRATION SENSORS ARE EMBEDDED NEAR THE LIME-PLASTER SURFACE.
- THE SENSORS CONTINUOUSLY MONITOR MOISTURE AND STRUCTURAL STRESS INSIDE THE WALL.
- DATA IS SENT TO A MICROCONTROLLER (ARDUINO) FOR AUTOMATIC ANALYSIS.
- IF THE VALUES CROSS A DANGER THRESHOLD, THE SYSTEM TRIGGERS AN ALERT.
- CARETAKERS CAN THEN TAKE PREVENTIVE ACTION USING LIME-BASED REPAIRS BEFORE VISIBLE DAMAGE OCCURS.

METHODOLOGY

[HERITAGE WALL]
↓ SENSORS EMBEDDED
[HUMIDITY SENSOR] [VIBRATION SENSOR]
↓ ↓
(DATA) → → → [ARDUINO / MICROCONTROLLER]
↓
(ANALYSES)
↓
[ALERT / NOTIFICATION]
↓
PREVENTIVE HERITAGE REPAIR (LIME-BASED)

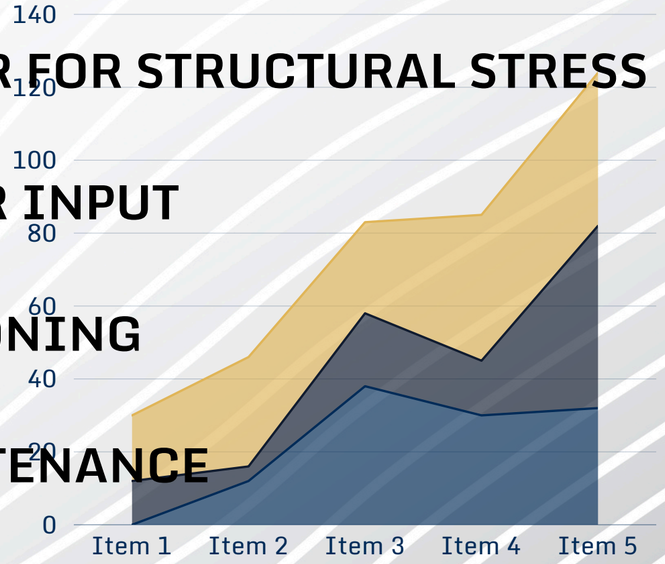
THIS SHOWS:

WALL → SENSORS → ARDUINO → ALERT → PREVENTIVE REPAIRINSTEAD OF REPAIRING
AFTER DAMAGE, THE SYSTEM PREDICTS AND PREVENTS IT. ”

Prototype & Technology Stack”

SENSORS USED:

- HUMIDITY SENSOR + VIBRATION/ACCELEROMETER SENSOR FOR STRUCTURAL STRESS
- CONTROLLER:
- ARDUINO-BASED MICROCONTROLLER TO PROCESS SENSOR INPUT
- POWER SOURCE:
- SMALL SOLAR UNIT FOR SUSTAINABLE, OFF-GRID FUNCTIONING
- COMMUNICATION:
- LOCAL INDICATOR/ALERT SYSTEM FOR PREVENTIVE MAINTENANCE
- MATERIAL INTEGRATION:
- WORKS SPECIFICALLY WITH LIME-SURKHI WALLS TO SUPPORT INDIGENOUS ARCHITECTURE



PROTECTING INDIA'S HERITAGE, SUSTAINABLY

- PRESERVATION: EXTENDS LIFE OF LIME STRUCTURES, PREVENTS COSTLY RESTORATIONS.
- CULTURAL IMPACT: MAINTAINS HERITAGE KNOWLEDGE AND TRADITIONAL MATERIALS.
- SUSTAINABILITY: USES SOLAR POWER AND INDIGENOUS MATERIALS.
- SCALABLE: DEPLOYABLE ACROSS FORTS, TEMPLES, VILLAS, AND HISTORICAL MARKETS NATIONWIDE.

WHY SANJEEVANI STANDS OUT

- TRADITIONAL + MODERN: COMBINES ANCIENT SELF-HEALING MASONRY WITH SMART SENSORS.
- PROACTIVE PRESERVATION: DETECTS PROBLEMS BEFORE CRACKS OCCUR.
- AFFORDABLE & INDIGENOUS: LOW-COST, LOCALLY IMPLEMENTABLE TECHNOLOGY.
- ENVIRONMENTALLY FRIENDLY: USES SOLAR POWER AND SUSTAINABLE MATERIALS.
- VISUALS: COMPARISON CHART: SANJEEVANI VS MODERN CEMENT REPAIRS (HIGHLIGHTING LONGEVITY, SUSTAINABILITY, COST).

OUR JOURNEY TO INNOVATION

- **CHALLENGES:**
  - CALIBRATING SENSORS FOR LIME WALLS, TESTING UNDER REAL CONDITIONS, INTEGRATING SOLAR POWER.
- **LEARNINGS:**
  - TEAMWORK, ITERATIVE TESTING, BALANCING TRADITION AND TECH.
- **OUTCOME:**

  A FULLY FUNCTIONAL PROTOTYPE READY FOR EARLY INTERVENTION IN HERITAGE PRESERVATION.

SCALING SANJEEVANI - A VISION FOR INDIA'S HERITAGE

NATIONWIDE DEPLOYMENT: FROM FORTS AND TEMPLES TO HISTORICAL MARKETS - PROTECTING EVERY LIME-PLASTERED TREASURE.

SMART INTEGRATION: MOBILE ALERTS, IOT DASHBOARDS, AND COMMUNITY MONITORING FOR PROACTIVE PRESERVATION.

REVIVING TRADITION: TRAIN NEW MASONS IN SUSTAINABLE LIME-BASED TECHNIQUES; REVIVE LOST CRAFTSMANSHIP.

GLOBAL POTENTIAL: ADAPTABLE FOR HERITAGE PRESERVATION WORLDWIDE, MAKING INDIA A LEADER IN SUSTAINABLE CONSERVATION.

IMPACT STATEMENT (BOLD, CENTERED):

"FROM REACTIVE REPAIRS TO PROACTIVE PRESERVATION - SANJEEVANI ENSURES INDIA'S CULTURAL LEGACY SURVIVES, THRIVES, AND INSPIRES."

BE PART OF INDIA’S HERITAGE REVOLUTION

“PROJECT SANJEEVANI IS NOT JUST A PROTOTYPE - IT’S A MOVEMENT TO SAVE OUR HISTORY, EMPOWER COMMUNITIES, AND PROTECT OUR IDENTITY.”

KEY MESSAGE:

“EVERY EARLY INTERVENTION TODAY PREVENTS IRREVERSIBLE DECAY TOMORROW. TOGETHER, WE CAN PRESERVE INDIA’S SOUL FOR GENERATIONS.”

“LET’S TRANSFORM HERITAGE CONSERVATION - FROM REACTIVE RESTORATION TO PROACTIVE PRESERVATION - WITH SANJEEVANI.”

THANK YOU

INVICTUS INTERNATION SCHOOL