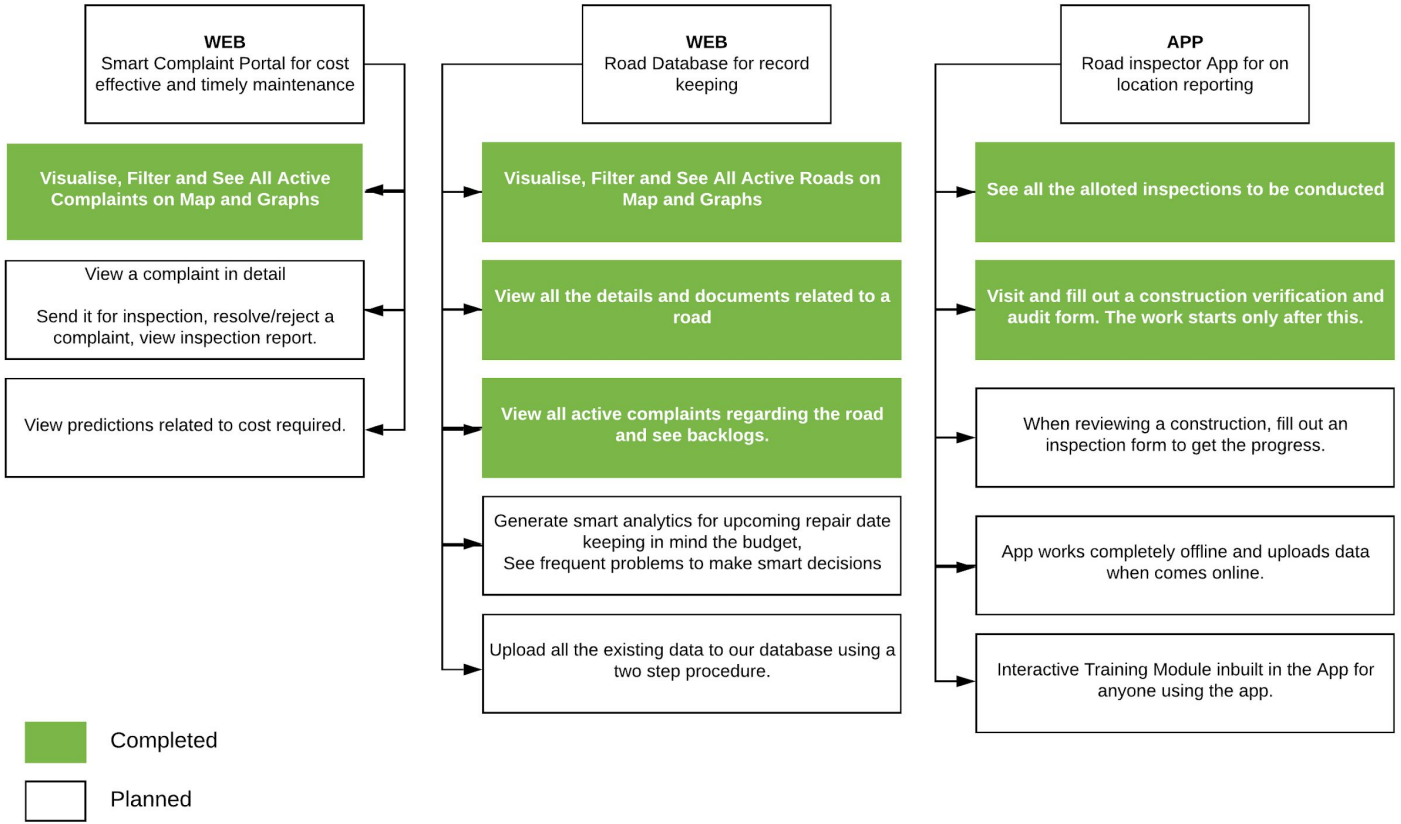
Humraahi

Road Portal Overview

Progress

Our portal is live at https://humraahi.netlify.app/ . You can view it there in your PC browser.



Covered aspects as per Problem Statement

S. No	Key Point	Proposed Solution
1.	**Record Keeping and Analysis**	An interactive Admin Portal with BI and data analytics tools
2.	**Schedule and Backlog**	Scheduling inspections, auto reminders for inspection based on priority of the task. Prediction of next probable repair with backlog analysis.
3.	**Regular on site inspections**	An Android App with offline support for the field officer consisting of verification and inspection forms.
4.	**Linkage with initial construction**	One click export of the legacy data, alongside proper linking of maintenance tasks with the initial construction data.
5.	**Fund Predictions and Utilization *(See Research)**	Cost prediction for road repair, road quality estimation, and prioritizing road repair task on basis of road importance.
6.	**Training to the workforce based on existing practices and knowledgebase of different road patterns.**	An interactive guide for using the field officer app and tutorial for every single inspection procedure, classified on the basis of road type. Also available on admin portal
7.	**An innovative reporting mechanism**	An Android app for the common civilians which provides a trip helper, alongside with background reporting of probable Potholes and road damage.

Queries from our side

We have listed all the points we could infer from the problem statement and have proceeded accordingly, however it would really help if you can answer to some of our queries

1. We wanted to verify if we have covered all the aspects from the problem statement and in the right manner. If not, we would really appreciate a feedback.
2. We have presented our research in the following sides, we are also using some custom defined metrics for prediction purpose (Thus using both ways, Scientific methods and Machine Learning based on Data), If there is something we are missing, please include that in the feedback.

Research

Prevalent system and technical details

We consulted two experts in this field, an XEN from PWD(Punjab) and India Head of a Road and Bridge construction company and understood a basic working of current system. We also read the following research papers on the cost and maintenance of road :

[1]https://digitalscholarship.unlv.edu/cgi/viewcontent.cgi?article=3089&context=thesesdissertations (Highway Routine Maintenance Cost Estimation for Nevada)

[2] https://sci-hub.tw/https://doi.org/10.1080/10298430310001634834 (Prediction of Pavement Remaining Service Life Using Roughness Data—Case Study in Dubai)

[3] https://www.nevadadot.com/home/showdocument?id=4044 (Development of Pavement Network Optimization System(Development of Pavement Performance Analysis and Procedures))

[4] https://core.ac.uk/download/pdf/55639943.pdf(THE DATA MINING APPLIED FOR THE PREDICTION OF HIGHWAY ROUGHNESS DUE TO OVERLOADED TRUCKS)

[5] https://www.mdpi.com/2079-9292/9/1/3/htm (Development of the Road Pavement Deterioration Model Based on the Deep Learning Method)

Research

Factors affecting road life
(Currently being used in practice)

Please see full forms and formulas on next slides.

1. IRI(m/km)
2. Age(year)
3. Initial IRI(m/km)
4. Equivalent Single Axle Load(number)
5. Crack(m)
6. Pothole(number)
7. Rut(mm)
8. Long Crack(m)
9. Present serviceability index (PSI)
10. HT_AADT
11. P&L_AADT

Research

Factors affecting road life
(Currently being used in practice)

PSI = 5.03 - 1.91 log(1+SV) -1.38 RD2 - 0.01 (C+P)0.5
PSI = 5*e-0.0041*IRI - 1.38RD2 - 0.01(C+P)0.5
IRI= international roughness index (in/mile)
RD= rut depth (in)
C= cracking area (ft2/1000ft2)
P= patching area (ft2/1000ft2)
PSI = 5exp(-IRI/5.5)
RSL = 1/b(ln(IRI/a)) - current age
a = The initial IRI value at age equal zero.
b = Measures the curvature of the performance line

$$IRI = 0{,}98 \times e^{m.t}\{IRI_0 + 135SNCK^{-5}.NE_t + 0{,}143RDS_t + 0{,}0068Crack_t + 0{,}056PAT_t\}$$

SNCK is the Modified SN by AASHTO, *NE* is the number of ESAL, *RDS* denotes rutting, *PAT* denotes patching, and *t* is the age of the pavement in years.

Research

Factors affecting road cost (repair)

(Currently being used in practice)

1. Total cost
2. HT_AADT
3. P&L_AADT
4. Age
5. AA_Temp
6. Shoulder width(feet)
7. No_shoulder(1 or 0)
8. Mountain(1 or 0)
9. Bridge(1 or 0)

Code	Measurement	Description
IRI	meter/kilometer (m/km)	International Roughness Index
Age	years	Age of Pavement
IRI_0	meter/kilometer (m/km)	Initial IRI
ESAL	number	Equivalent Single Axle Load
Crack	square meter (m^2)	Cracks predominantly parallel to pavement centerline
Potholes	number	Record number of potholes
Rut	millimeters (mm)	Record maximum rut depth
Long Crack	meter (m)	Record the length

$$TotalCost = \beta_1 (HT\_AADT)^{\beta_2} (P\&L\_AADT)^{\beta_3} (AGE)^{\beta_4} (AATEMP)^{\beta_6} (SHOULDER)^{\beta_5} \ldots$$
$$(e^{NOSHOULDER'})^{\beta_7} (e^{MOUNTAIN'})^{\beta_8} (e^{BRIDGE'})^{\beta_9} (e^{MNCOLLCTR'})^{\beta_{10}} (e^{DISTRICT2'})^{\beta_{11}} (e^{DISTRICT11'})^{\beta_{12}}$$