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AI AS A SUPPORT TOOL FOR TRAFFIC WARDENS: SURVEY EVIDENCE ON FAIRNESS, PRIVACY AND DISPUTE REDUCTION

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Abstract:

India's traffic challan system relies heavily on traffic wardens who issue fines on the spot. While this human-driven process allows flexibility, it often suffers from errors. Drivers may be fined due to misjudgement, incomplete evidence, or bias, while genuine violations sometimes go unnoticed in crowded or complex traffic situations. These mistakes frustrate citizens, waste administrative effort, and weaken trust in enforcement.

This paper explores how AI can support traffic wardens in making fairer and more accurate decisions. Instead of replacing wardens, AI tools can act as assistants: mobile apps that verify license plate details instantly, machine learning models that flag likely violations based on context, and decision-support systems that help wardens distinguish between genuine offenses and unavoidable actions (such as stopping briefly to avoid an accident). By reducing false positives and strengthening true violation detection, AI can make manual enforcement more transparent and trustworthy.

The vision is a hybrid system where human judgment is enhanced and not replaced by AI, leading to smarter enforcement and stronger public confidence in traffic governance.

Keywords*: Traffic Challan, Artificial Intelligence, Traffic Warden.*

Introduction:

Traffic enforcement is a cornerstone of road safety in India. At present, much of this responsibility rests on traffic wardens who issue fines manually. While this system allows flexibility and human judgment, it is prone to errors. Wrongful fines not only frustrate citizens but also weaken trust in penalty system(Jeevan, Sharma, & Desai, 2024).On the other hand, genuine violations often go unnoticed or result into bias of wardens.

This paper examines how AI can be introduced as a supportive tool to assist wardens in their decision-making. The aim is not to replace human judgment but to strengthen it, ensuring that enforcement is both fair and transparent.

Literature Review:

Most Traffic enforcement in India remains largely manual, which often leads to errors and disputes. Existing research on AI in traffic management has focused on automated violation detection using cameras and sensors (Sutar, 2025; Gowda et al., 2024). These studies show that AI can improve accuracy but emphasize automation rather than human-assisted enforcement.

Scholars also highlight the importance of fairness and governance in AI adoption. Shah and Harikumar (2024) note that India's legal frameworks must evolve to safeguard privacy and ensure transparency. International case studies, such as Singapore's Smart Nation initiative and UK transport projects, demonstrate that AI can enhance efficiency but require citizen trust and phased implementation.

Survey-based studies (Jeevan et al., 2024) reveal that while citizens see value in AI for fairness and

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transparency, concerns about privacy and training persist. This aligns with the present study's focus on a hybrid model where AI supports wardens rather than replacing them.

Problem Statement:

Manual challan issuance suffers from several challenges. Wardens may misidentify vehicles, issue fines without complete evidence, or act with bias. In crowded traffic situations, genuine violations may go unnoticed. These issues lead to disputes, waste administrative resources, and breaks public trust. Citizens always feel that Traffic wardens are unfair, biased & inconsistent(Jeevan et al., 2024).

Proposed Framework:

The proposed framework introduces AI as a supportive tool for wardens. Mobile applications can allow wardens to scan license plates and instantly verify vehicle details. Machine learning models can flag likely violations based on traffic context, reducing bias and misjudgment(Gowda et al., 2024). Decision-support systems can help wardens distinguish between genuine offenses and unavoidable actions. AI can also assist in capturing photo or video evidence, ensuring that challans are backed by reliable documentation.

This hybrid approach ensures that enforcement remains human-driven but is strengthened by technology.
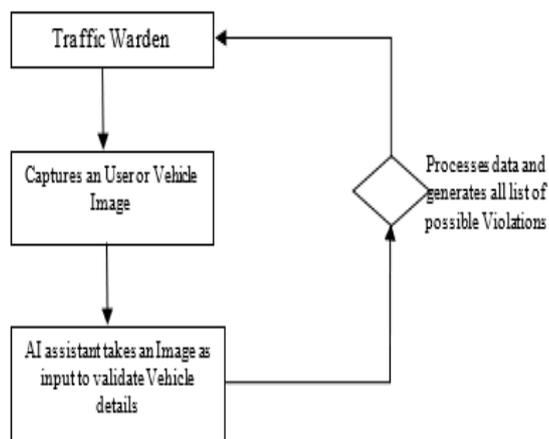
Sample Process Flow

Implementation Considerations:

For successful implementation, wardens must be trained to use AI tools effectively. Infrastructure such as handheld devices and cloud connectivity will be required. Integration with government databases like RTO and DigiLocker will ensure seamless operation. A phased rollout beginning with metro cities and expanding nationwide is recommended.

Ethical and Legal Concerns:

Introducing AI into traffic enforcement raises important ethical and legal questions. Privacy of citizen data must be safeguarded. AI models should be designed to avoid bias and ensure fairness across regions(Shah & Harikumar, 2024). Transparency is essential, with clear appeal mechanisms for disputed challans. Legal frameworks such as the Motor Vehicles Act will need to be updated to formally recognize AI-assisted enforcement.

Expected Outcomes:

The proposed system is expected to reduce wrongful fines, strengthen the evidence base for challans, and increase citizen trust in enforcement(Sutar, 2025; Jeevan et al., 2024). Citizens will benefit from fairer treatment and reduced disputes, while wardens will gain efficiency and confidence in their decisions. Over time, this hybrid model can lead to safer roads and stronger governance.

Survey Questions to understand perception of People

1. Do you think, traffic challans issued manually are fair and accurate?

2. Have you experienced or witnessed wrongful fines in the current system?

3. Wrongful fines reduce trust in traffic penalty system?

4. Do you believe that AI can make traffic rules violation penalty system more transparent and fairer?

5. Would you be comfortable with AI being used in traffic enforcement, provided privacy safeguards are in place.

6. Do you think AI assistance can reduce disputes over wrong fines.

7. Any opinion around adoption of AI assistant for Traffic wardens?

Survey Results:

Sr No.	Do you think, traffic challans issued manually are fair and accurate	Have you experienced or witnessed wrongful fines in the current system?	Wrongful fines reduce trust in traffic penalty system?	Do you believe that AI can make traffic rules violation penalty system more transparent and fairer	Would you be comfortable with AI being used in traffic enforcement, provided privacy safeguards are in place.	Do you think AI assistance can reduce disputes over wrong fines
1	5	No	Yes	Yes	3	5
2	6	No	Yes	Yes	5	6
3	2	No	No	Yes	4	5
4	1	Yes	Yes	Yes	4	5
5	3	Yes	Yes	No	3	2
6	6	No	Yes	Yes	4	3
7	1	Yes	Yes	No	1	5
8	4	No	Yes	No	2	5
9	7	Yes	Yes	Yes	4	5
10	7	Yes	Yes	Yes	5	7
11	4	No	Yes	Yes	5	7
12	7	No	Yes	Yes	5	7
13	2	Yes	Yes	Yes	4	4
14	1	Yes	Yes	Yes	1	4
15	4	No	Yes	Yes	4	5
16	6	No	No	Yes	3	7
17	4	Yes	Yes	No	3	4
18	2	No	Yes	Yes	3	4
19	4	No	Yes	Yes	5	7
20	3	No	Yes	Yes	4	4
21	4	No	Yes	Yes	3	5
22	2	Yes	Yes	Yes	5	5
23	4	Yes	Yes	Yes	4	5
24	3	Yes	Yes	Yes	3	4
25	3	Yes	Yes	No	3	3
26	1	Yes	Yes	Yes	3	7
27	3	Yes	No	Yes	3	3
28	4	Yes	Yes	Yes	3	5
29	3	No	Yes	Yes	4	6
30	7	Yes	Yes	Yes	3	5
31	4	Yes	Yes	Yes	3	3
32	1	Yes	No	Yes	4	6
33	1	No	Yes	Yes	4	6
34	4	No	Yes	No	3	5

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Sr No.	Do you think, traffic challans issued manually are fair and accurate	Have you experienced or witnessed wrongful fines in the current system?	Wrongful fines reduce trust in traffic penalty system?	Do you believe that AI can make traffic rules violation penalty system more transparent and fairer	Would you be comfortable with AI being used in traffic enforcement, provided privacy safeguards are in place.	Do you think AI assistance can reduce disputes over wrong fines
35	4	No	Yes	Yes	4	6
36	1	Yes	Yes	Yes	3	4
37	3	Yes	Yes	Yes	2	5
38	4	No	Yes	Yes	1	1
39	2	Yes	Yes	Yes	5	7
40	4	No	No	Yes	1	1
41	1	No	Yes	Yes	3	5
42	7	Yes	Yes	No	1	2
43	1	Yes	Yes	Yes	5	5
44	3	Yes	Yes	Yes	5	7
45	1	Yes	Yes	Yes	4	6
46	1	Yes	Yes	Yes	3	3
47	1	Yes	Yes	Yes	4	5
Mean	3.32	N/A	6.36	6.11	3.43	4.81
Neutral Point	4	N/A	4	4	3	4
t-Statistic	-2.41	N/A	8.66	6.69	2.48	3.53
p-Value	0.0199	N/A	0	0	0.0167	0.001

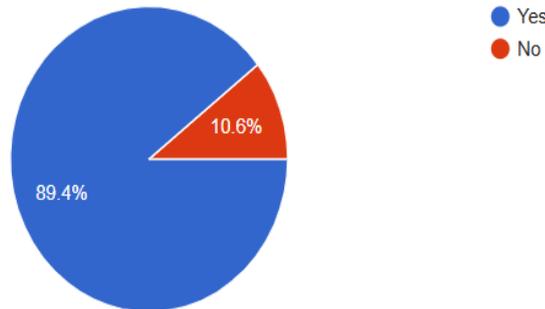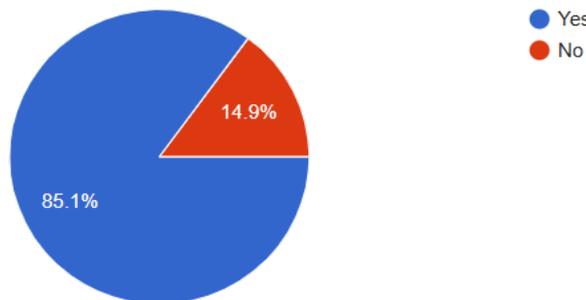*7-point scale midpoint = 4; 5-point scale midpoint = 3; Yes=7, No=1*
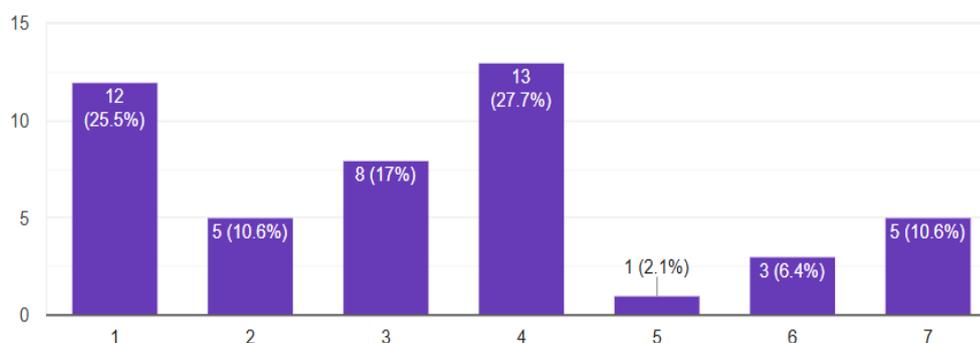
Out of 47 respondents, many reported dissatisfaction with the fairness of manual challans.
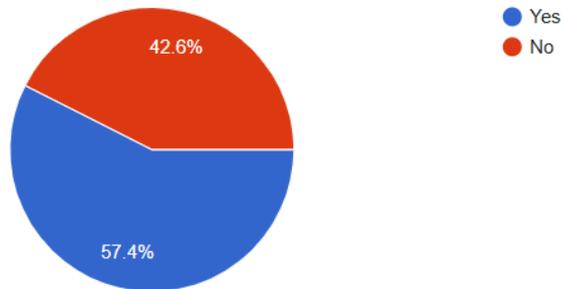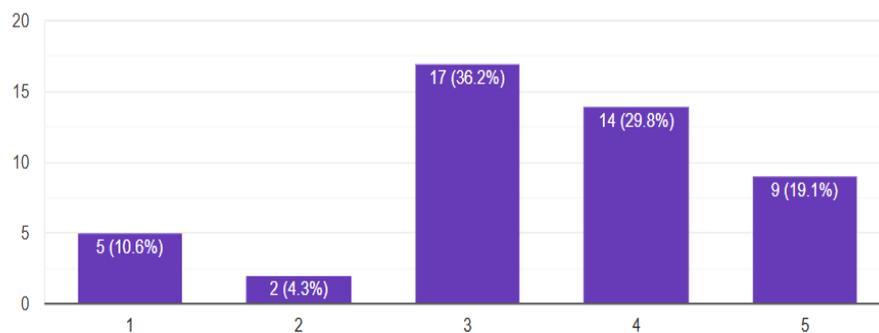
Majority of People have experienced or witnessed wrongful fines in current system
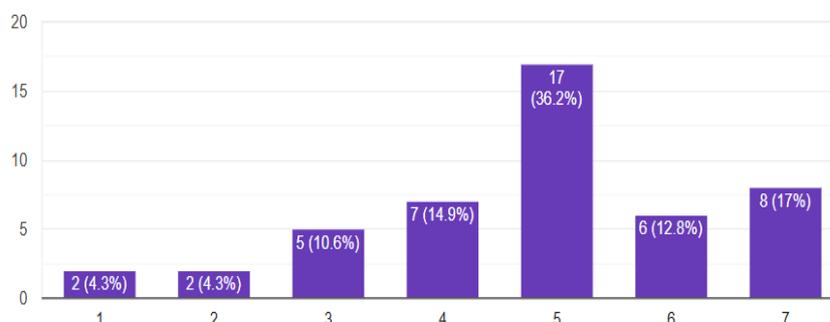

People have strong restraint against wrongful Fines

Survey results indicate that respondents believe AI adoption could enhance transparency and fairness in enforcement.

Many people are satisfied or neutral with privacy with AI if proper measures are in place

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More then 50% of people believe that AI assistance can reduce fines dispute, few people are Neutral as well

When Asked on any different views on adoption of AI assistant for Taffic Warden below is Summary of opinion from people:

- AI Assistant can be very supportive tool for Traffic Wardens
- Respondents emphasized that AI should support traffic wardens rather than replace them.
- Respondents expressed concerned with Privacy as well
- Respondents are also concerned with having too many AI assistants
- Respondents also see Training of AI models as an item to consider
- Training user is also an aspect which people have thought should not be overlooked.

Hypothesis Testing:

For following paper, we are using Hypothesis testing, which is a statistical reasoning that supports in analysing data from a sample to derive outcome about a population. First, a hypothesis is created regarding the parameter. This is known as the null hypothesis, abbreviated as H_0. After that, an alternative hypothesis (denoted H_1) is defined, which is the opposite of the null hypothesis. Using sample data, the hypothesis testing technique determines whether or not H_0 may be

rejected. The statistical conclusion is that the alternative hypothesis H_1 is true if H_0 is Rejected.

Null Hypothesis (H_0):

Citizens remain neutral toward the use of AI in traffic challan enforcement, with no significant improvement in perceptions of fairness, transparency, or trust compared to the current manual system.

Alternative Hypothesis (H_1):

Citizens perceive AI assistance in traffic challan enforcement as significantly improving fairness, transparency, and trust compared to the current manual system.

Test (Statistics):

There are many tests available to determine if the null hypothesis is to be rejected or not. Some are:

1. Chi-squared test
2. T-student test (T-test)
3. Fisher's Z test.

A one-sample t-test was chosen to compare mean responses against the neutral midpoint, as the data was approximately normally distributed and the sample size (n = 47) was sufficient for parametric testing. Normality was checked and the t-test is robust for n=47. Steps involved in Testing are listed as below:

1. Data Collection: Gathering responses using google form on Likert Scale 1 to 7, Likert Scale 1 to 5 , Yes & No, also some Open comments.

2. Data Preparation: Exported responses in Excel, and dropped non numeric values & re-coded yes/no as 7/1 for computation.

3. Hypothesis:

   a. Null Hypothesis (H_0): Citizens are neutral (mean = midpoint of scale)

      i. For 7 - point questions, neutral = 4

      ii. For 5 - point question, neutral = 3.

   b. Alternative Hypothesis (H_1): Citizens significantly differ from neutral (mean $\neq$ midpoint).

4. Statistical Test: Applied One-Sample T-test for each question, compared to mean & interpreted results based on p-value(<0.05 significance)

5. Interpretation:

   a. Mean is lower than mid-point & significant, Citizens are favouring towards negative

   b. Mean is greater then mid-point & significant, Citizens are favouring towards positive

   c. $p \geq 0.05$, shows Citizens are neutral

Outputs:

● **Category: Perceived fairness of manual system**
   Question: Do you think, traffic challans issued manually are fair and accurate
   Sample size = 47
   Mean = 3.32, Neutral = 4, t-stat = -2.41, p-value = 0.0199
   Due to significant difference from neutral we will reject H_0

● **Category: Trust in enforcement**
   Question: Wrongful fines reduce trust in traffic penalty system?
   Sample size = 47
   Mean = 6.36, Neutral = 4, t-stat = 8.66, p-value = 0.0000
   Due to significant difference from neutral we will reject H_0

● **Category: Perceived effectiveness of AI**
   Question: Do you believe that AI can make traffic rules violation penalty system more transparent and fairer
   Sample size = 47
   Mean = 6.11, Neutral = 4, t-stat = 6.69, p-value = 0.0000
   Due to significant difference from neutral we will reject H_0

● **Category: Comfort with AI given privacy safeguards**
   Question: Would you be comfortable with AI being used in traffic enforcement, provided privacy safeguards are in place.
   Sample size = 47
   Mean = 3.43, Neutral = 3, t-stat = 2.48, p-value = 0.0167
   Due to significant difference from neutral we will reject H_0

● **Category: Perceived dispute reduction**
   Question: Do you think AI assistance can reduce disputes over wrong fines
   Sample size = 47
   Mean = 4.81, Neutral = 4, t-stat = 3.53, p-value = 0.0010
   Due to significant difference from neutral we will reject H_0

Conclusion:

This paper proposes a balanced approach where AI supports traffic wardens without replacing them. Survey findings show that citizens doubt the fairness of manual challans but see clear value in AI assistance, primarily for reducing disputes and improving transparency. Privacy remains a key concern, however, overall findings support a hybrid model in which AI strengthens warden's decisions rather than replacing human judgment. With proper safeguards and training, AI can enhance trust in traffic enforcement and contribute to safer, more efficient roads in India.

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Limitation:

AI relies on training data set to train or follow, hence there is dependency on correct training data. Usage of AI has a risk of data being shared (even for training purpose) and it can breach persons privacy. AI may fail in case of lack of connectivity or Network, also at same time if AI is not able to collect data from source systems, whole system might not be able to serve its purpose on given time. AI can predict wrong Judgements if integrated with other input devices, however can also work as extra layer of proof collection.

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