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MATIKETAN Utilization of IT Infrastructure to Support the Development of Mobile Applications for Road Traffic Violation Ticketing

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Abstract: - There is an increasing trend in the number of fines, traffic citations, and arrests for traffic infractions among motorists in the present day. Over the past few years, there has been a tightening of traffic restrictions and an increase in penalties. Both small and major traffic violations are considered serious charges or allegations. This study aims to address the limitations and problems of the current method by creating a mobile application for a road traffic infraction ticketing system in Ilocos Norte. The study aimed to achieve the following objectives: firstly, to analyze and assess the different factors that contribute to traffic violations and the difficulties associated with the traditional method of capturing and processing violations; secondly, to conduct a comprehensive review of technologies that could be used to capture and process violations in a more effective and convenient way; and finally, to develop and implement a system that would enhance the reporting, payment, and monitoring of traffic violations in Ilocos Norte. Semi-structured interviews and survey questionnaires were employed for data collection. Respondents for the study were identified using user identities. The system's development incorporated RAD, which stands for Rapid Application Development. Based on the results of the users' acceptability test, it was determined that both the online and mobile applications of The Matiketan were considered acceptable. Based on the conclusions and findings, the researcher recommends that the appropriate office should accept and implement the system.

Keywords: MAtiketan, Road Traffic Violation, E-payment, Ticketing, Mobile Application and Web Application.

I. INTRODUCTION

The influence of automation on both worldwide and daily existence is expanding. Computers are utilized to execute office functions. Automation in government contributes to increased efficiency and productivity, leading to overall societal success [Schleyer, 17]. Automation serves as a versatile weapon and tool for information retrieval and operations, enabling electronic access, retrieval, and conveyance of information that is accessible to all.

Technological breakthroughs are creating new opportunities for creativity and causing a revolution in the workplace. The integration of mobile and online applications into these technological gadgets has significantly improved communication and productivity inside an enterprise.

The police have encountered a novel challenge in enforcing educational penalties without ensuring their deterrent effect, primarily due to the increase in traffic infractions. Administrative punishments might be employed to suppress the violation (ticketed). E-ticketing technology will supplant the manual ticketing method by issuing a blank or paper ticket that includes the pertinent information of the driver in violation. The Traffic and Road Transport Information and Communication System is explicitly defined in the Indonesian Traffic and Road Transportation Law. A network of networked computers designed to collect, store, and distribute information in order to improve transportation services. The aim of this study was to examine the benefits of Indonesia's electronic ticketing system. The research monitored Indonesian law enforcement agents as they conducted inquiries into claims of traffic infractions. Furthermore, the study analyzed the limitations of the E-ticket system as enforced by the police [Wahyuningsih & Iksan, 19].The Department of Public Safety (DPS) reported that Laoag City had a total of 32,557 documented traffic offenses, out of which only 26,047 individuals complied with the payment of fines. In the subsequent year, there was a 12.60% surge, with a total of 29,171 offenders resolving their fines in 2019.

The manual capture and handling of infractions require significant time and effort, which can pose challenges in some situations. Hence, transitioning from the existing system to an online one could prove beneficial for all parties concerned, including traffic enforcers, city treasury officials, DPS, and, naturally, the offenders themselves when it comes to settling the penalties.

The tool aims to optimize the process of digitally documenting, remitting, documenting, and monitoring traffic fines. Hence, the objective of the proposed approach is to facilitate internal communication, foster collaboration among parties to address issues, and encourage unrestricted exchange of information.

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II. METHODOLOGY

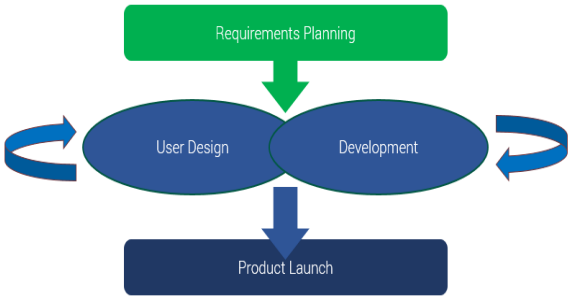

Figure 1: Rapid Application Development (RAD)

Data is gathered through interviews. Information regarding the conventional approach to collecting and processing infractions was gathered through a semi-structured interview. Additionally, we learned about the challenges that the old method of handling traffic violations in Laoag City has. Personal interviews were conducted with each participant. Personal interviews were carried out.

One kind of agile software development, the iterative model prioritizes small, incremental changes. As time goes on, the implementation gets more complicated and adds more features until the final system is ready.

Research using the Rapid Application Development (RAD) methodology is shown in Figure 1. Needs analysis, user design, construction, and cutover were the several steps that made up this process.

In order to gather information for the requirement plan, the researcher spoke with the collecting officers. We conducted these interviews to learn more about the reasons people don't pay their traffic tickets or get them resolved, and the problems people have with the standard process for doing so.

The researcher meticulously analyzed the system's features and operational functions during the User Design Phase. Additionally, the researcher went over the necessary system physical and logical design. In order to improve the system's user interface, the researcher used these templates.

Early on in the development process, the researcher mapped out the software needs from the users. The program was built utilizing a wide variety of programming languages and editing programs.

All the components constructed in the implementation phase were merged into a system after the Product Launch Phase's testing of individual units. Many problems were discovered and tested throughout the post-integration phase of the whole system. By making sure the codes were correct and appropriate for the needs of the study, we were able to confirm that the component worked as expected.

2.1 User Acceptance Test

To find out if the process under the Research and Development methodology was successful, the users evaluated MAtiketan: Mobile Application for Road Traffic Violation Ticketing. There were 444 assessors in the data set.

The researcher had given some users a crash course on the technology's operation and given them an orientation. It was predicted that some assessors might be a bit confused when utilizing the new system.

As the basis for the user acceptance test questionnaires, the ISO/IEC 25010 was considered the bedrock of a system for assessing product quality. The system's eight (8) components were assessed by the aforementioned questionnaire. The attributes include things like functional sustainability, efficiency in performance, interoperability, usability, reliability, security, maintainability, and portability.

The researcher and the statistician worked together to collect, tabulate, analyze, and interpret the data. In order to analyze and understand the data, many statistical methods were used.

The system's validity was assessed by calculating the weighted mean. Here is how the responses of the users were coded for the acceptability test:

Table 1: Range of Mean Descriptive Interpretation

Range of Mean Values	Descriptive Interpretation
4.51- 5.00	Excellent
3.51- 4.50	Very Satisfactory
2.51- 3.50	Satisfactory

1.51-2.50	Needs Improvement
1.00- 1.50	Poor

III. RESULTS AND DISCUSSIONS

The evaluation results of the developed web and mobile application, using the user's acceptance test based on the ISO 25010 standard, are presented. The system design and features of the research are also included.

3.1 System Design

Figure 2 illustrates the spatial configuration of the system, including the traffic enforcer, drivers who violate the law, collection officials, and monitoring officers. Accessing the database server of the system requires an active internet connection.

The mobile software was designed for both law enforcement authorities and individuals who engage in traffic infractions. The program utilized a GSM cloud server connection to streamline the process of authentication, file storage, online payment options, and database access. Furthermore, similar functionalities were also available to users of the mobile application.

The web application was designed to generate reports for gathering and monitoring staff based on user-entered data.

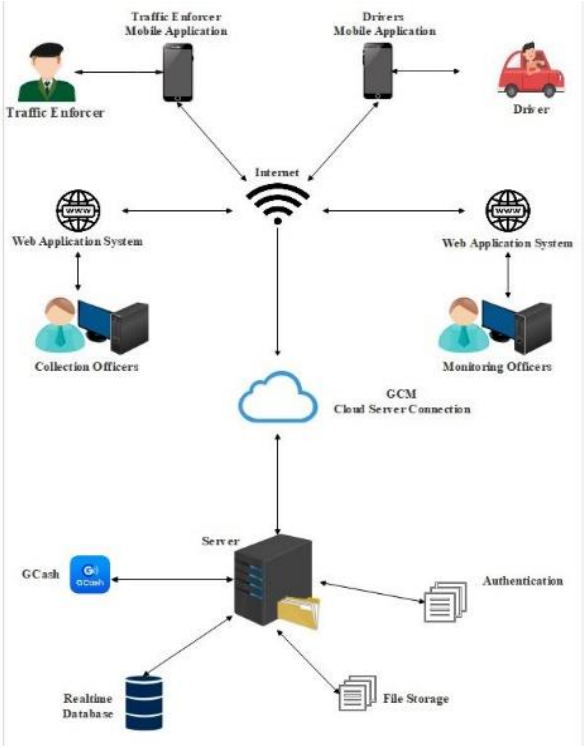

Figure 2. Physical Diagram of the System

3.2. Driver's Application Activity

The Figure 3 shown the login form is the first activity that is displayed upon opening the application wherein the users can create the account, input the email and password to access the application.

Figure 3: Account Registration Module

The users can view all the listed violations committed that needs to be settled shown in Figure 4.

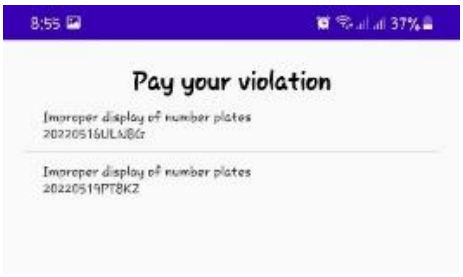

Figure 4: List of Penalties Module

The application can display the list of all the violation committed, namely; the violations information, penalty, and ciatiaon number show in Figure 5.

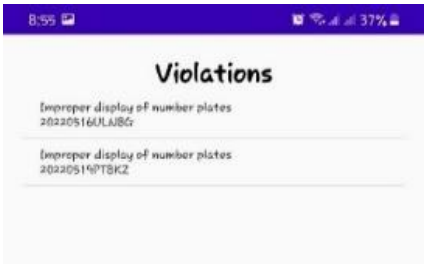

Figure 5: List of Violation

The application can generate its own QR code for the basic information needed by the traffic enforcers shown in Figure 6.

Figure 6: QR Code

3.3. Traffic Enforcer's Application Activity

The user can use this form to select a violator or view the violator's information shown in Figure 7.

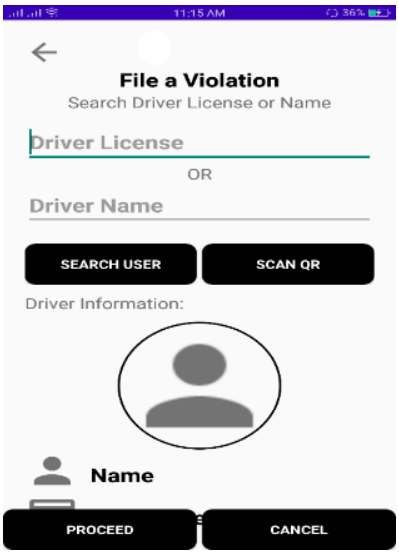

Figure 7: File Violation Module

The users can select the category of traffic violation for reports shown in Figure 8.

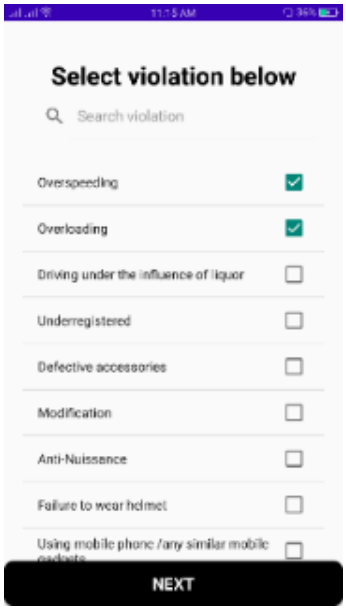

Figure 8: Violation List

The application can display the information of the committed violation/s and Penalties of the Violators shown in Figure 9.

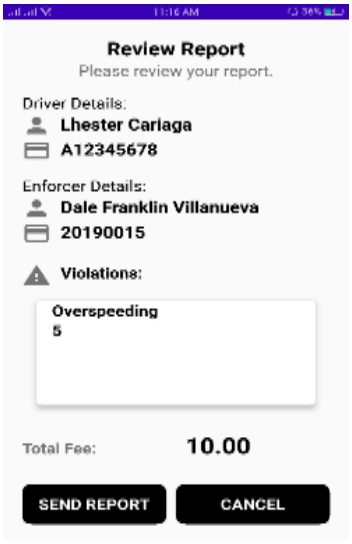

Figure 9: Report

3.4 Administrator Activity

The administrator can give the statistical reports for all the transactions done by the mobile application show in Figure 10.

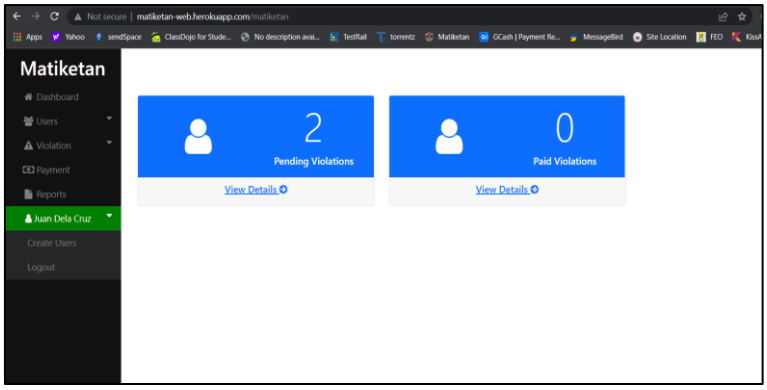

Figure 10: Monitoring Module

3.6. Users Acceptance Testing Results

During the research and development (R&D) phase, users assessed the effectiveness of MAtiketan, a mobile application designed for issuing tickets for road traffic violations. The web application underwent evaluation by ten DPS monitoring officers and fifteen collection officers from the City Treasury Office, while the mobile application was utilized by three hundred and eighteen drivers and fifteen traffic enforcers.

Figure 11 displays the outcomes of the approval procedure specifically related to the users who have been identified. The mean evaluations for functional appropriateness, accuracy, and completeness were 4.10, 4.18, and 4.19, respectively, indicating a very good performance. Based on user comments, the application demonstrates consistent performance in task completion and accurate provision of information, particularly in the areas of recording and processing infractions. This is supported by the evaluators' highly favorable response, as evidenced by a composite mean score of 4.10.

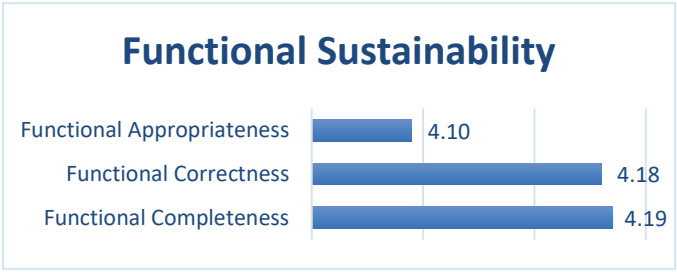

Figure 11: Functional Sustainability

Figure 12 illustrates the application's performance efficiency, with mean scores of 4.17 (Very Satisfactory) for capacity, 4.22 (Very Satisfactory) for resource consumption, and 4.25 (Very Satisfactory) for time-behavior. where the application can maintain correct functionality despite having a substantial user base. The assessors gave the program an average rating of 4.21 out of 5. They praised its ability to work well on different mobile devices and its capability to update information instantly with a reliable data connection.

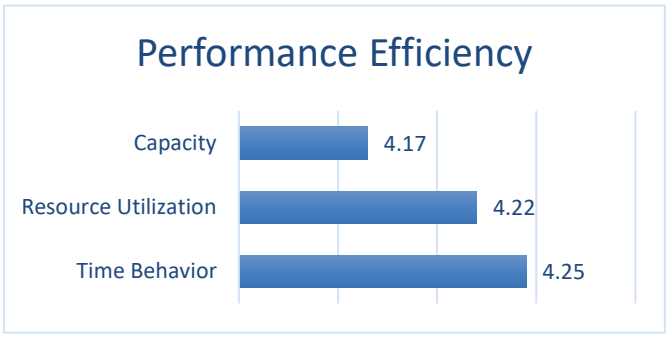

Figure 12: Performance Efficiency

Figure 13 displays the outcomes of the compatibility assessment, with average ratings of 3.94 for interoperability and 3.97 for coexistence, suggesting a highly satisfactory level. The assessors' composite mean score of 3.96 shows that they believed the principles of information sharing without causing harm to other users and the opportunity to trade information were sufficiently addressed.

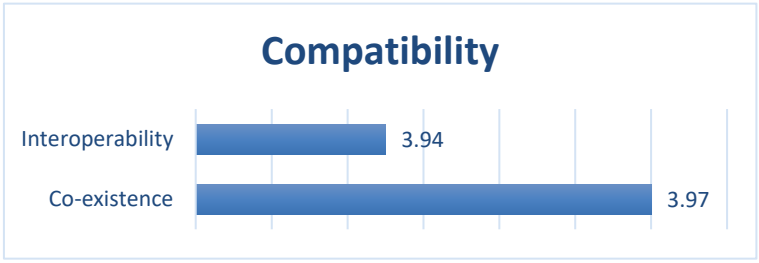

Figure 13: Compatibility

Figure 14 displays the usability scores of the program. The ratings are as follows: accessibility (4.11, Very Satisfactory), user interface aesthetic (3.91, Very Satisfactory), operability (3.97, Very Satisfactory), learnability (3.89, Very Satisfactory), and appropriateness recognizability. The reviews from verified users corroborate this assertion on the effectiveness and user-friendliness of the product (average score of 4.19).

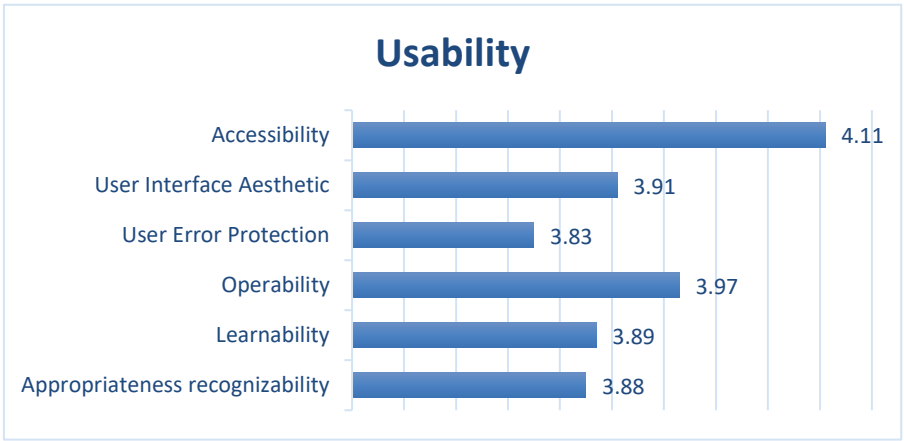

Figure 14: Usability

A mean score of 4.13 (Very Satisfactory) for recoverability, 4.09 (Very Satisfactory) for fault tolerance, 4.13 (Very Satisfactory) for availability, and 4.30 (Very Satisfactory) for maturity are depicted in Figure 15, which illustrates the evaluation of the application based on its reliability. The composite mean score of 3.91, which is a very favorable response from the evaluators, demonstrates that the application is capable of recovering and continuing to function well despite any process failure that may occur during its operation. This is demonstrated by the information presented here.

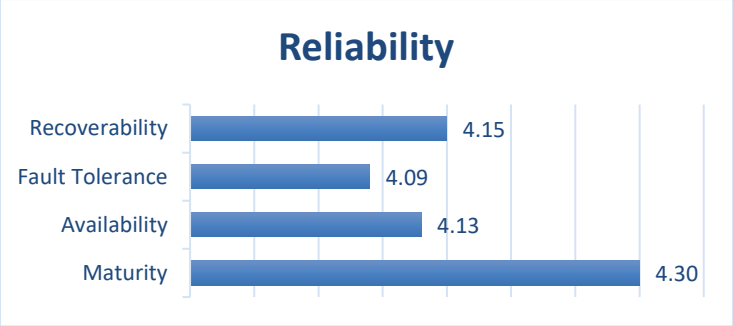

Figure 15: Reliability

The application's security mechanisms, as depicted in figure 16, demonstrated high levels of authenticity, accountability, non-repudiation, integrity, and secrecy. Based on the evaluation results, the program effectively ensures the anonymity and authenticity of its users. The composite mean rating of 4.25 indicates a high level of satisfaction.

Figure 16: Security

Refer to Figure 17 for the Maintainability, which displays the average values for testability, modifiability, analyzezability, reusability, and modularity as 4.28, 4.11, 3.99, and 3.89, respectively, indicating a very satisfactory level. The assessors responded extremely positively to the findings, which indicate that the application can be easily modified, analyzed, and assets may be reused. Testing the functionalities is a simple and direct process.

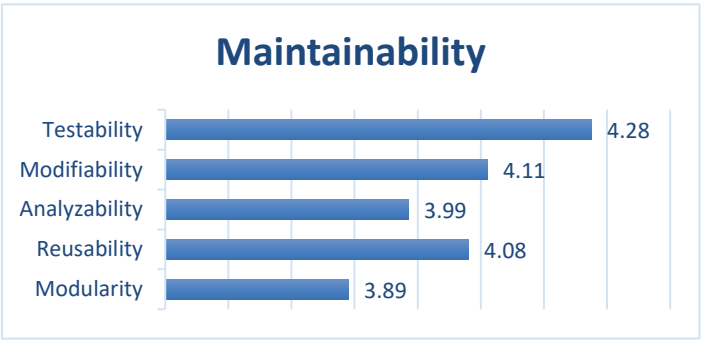

Figure 17: Maintainability

Lastly, the portability of the application when it comes to the adaptation and installation is shown in figure 18 where the replaceability has a mean of 4.11 (Very Satisfactory), Installability has a mean of 4.32 (Very Satisfactory) and adaptability has a mean of 4.24 (Very Satisfactory). The result imply that the application is easy to install and compatible in any android devices justified by the composite mean of 4.23 a very satisfactory response by the identified users.

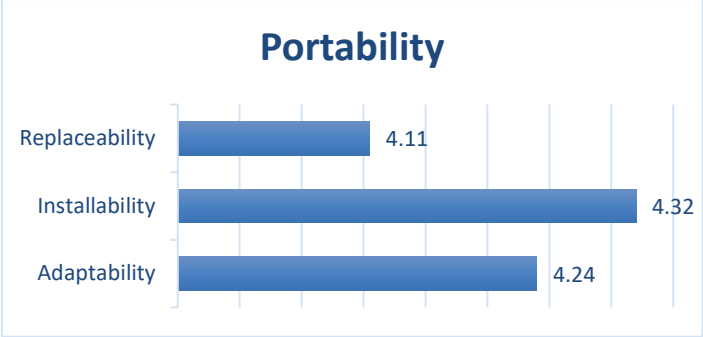

Figure 18: Users Acceptance Testing Results

Table 2 displays the average score of the application's user acceptability test, which is based on the evaluation and acceptance of ISO 25010 by the identified users. Scoring 4.11, the interpretation of the conclusion is highly satisfactory, indicating that the application provides significant support to DPS, city treasury workers, and traffic enforcers.

Table 2: Weighted Mean Descriptive Interpretation

Criteria	Mean	Interpretation
Functional Sustainability	4.10	Very Satisfactory
Performance Efficiency	4.21	Very Satisfactory
Compatibility	3.96	Very Satisfactory
Usability	4.19	Very Satisfactory
Reliability	3.91	Very Satisfactory
Security	4.25	Very Satisfactory
Maintainability	4.07	Very Satisfactory
Portability	4.23	Very Satisfactory
Overall Mean	**4.11**	**Very Satisfactory**

IV. Conclusions

The manual collecting and processing of violations can be quite burdensome in certain situations, requiring a significant amount of time and effort. The study highlights the importance of creating a system application to address the issues faced by several agencies responsible for managing traffic violations.

The outcomes analysis played a crucial role in defining the characteristics and capabilities of the system application. It also helped define rules for software development by conducting software development methods and assessments. The designed web application and mobile app will greatly benefit end-users, such as traffic collection and monitoring officials, traffic regulation enforcement police, and traffic law violators.

In order to make any improvements or alterations to the traffic infractions ticketing system now implemented in Laoag City, Ilocos Norte, it is crucial to offer end-user support, training, and seminars.

V. Future Work

This work can be replicated by researchers from other provinces. Potential areas for further research include exploring additional categories of traffic violations. The system could be improved and made compatible with various platforms and operating systems. Expanding the network of participating merchants would facilitate online payments. Furthermore, integrating a license ID scanner in collaboration with the Land Transportation Office (LTO) could introduce valuable additional features.

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