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Leveraging Machine Learning and Data Analytics to Study the U.S. Rental and Homelessness Crisis

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I. INTRODUCTION

Housing is a key factor in the stability and well-being of individuals and families across the United States. However, millions of households across the country are struggling with significant housing burdens, from structural inadequacies and cost burdens to crowded housing in unlivable conditions. These issues have profound ethical, social, and economic implications. They impact the quality of life for the impoverished and contribute to broader systemic inequalities, increasing poverty, straining healthcare and social services, and interrupting educational opportunities. Inadequate housing access leads to harmed health, job mobility, and access to resources provided by a community, making it hard to break the cycle of poverty with constant disadvantage.

This crisis in housing access mainly impacts low-income families and marginalized groups, reflecting themes of social inequality across American generations. Ethical concerns include the large divide between the impoverished and affluent, while access to affordable housing plummets. Economically, the prevalence of housing issues leads to inefficiencies in the labor market, limited mobility, and decreased productivity due to the instability of low-income households or individuals who lack housing. It is increasingly important to understand these issues to create interventions aimed at deterring homelessness, in turn growing the economy and promoting comprehensive social equality.

This report analyzes the scope of prevalent issues in households, focusing on income disparities and housing tenure, using data from the United States Office of Policy Development and Research's American Community Survey from 2017 to 2021.

Four main household problems are highlighted in this report: Incomplete Kitchen Facilities, Incomplete Plumbing Facilities, Overcrowding, and Cost Burden. Cost burdens are classified as spending over 30% of household income on housing, where a severe burden exceeds 50% spent. The dataset categorizes households by income level (HAMFI1) to uncover the depth of housing affordability and its implications for society, policy development, and the national economy

II. PURPOSE

The research in this paper examines the housing Crisis in the United States, focusing on key issues that impact homeowners and renters. This issue is highly important because housing instability contributes to poor health, limited educational opportunities, and strained public resources, especially for low-income households.It is important to analyze this data from the 2017-2021 American Community Survey because it aids in acquiring a comprehensive understanding of issues impoverished households face, and how economic disparity from housing issues impacts housing tenure.

Themes the Data is Analyzed on Based on Information Gathered through the Datasets

- Housing Problems
- Severe Housing Problems
- Income distribution and Housing issues
- Cost Burden

A main problem faced in the United States housing crisis is overcrowding and inadequate facilities. A potential solution for this would be to implement rent control and regulations so rented housing is regulated without inadequate amenities or facilities, and housing only carries the number of individuals it can support. Another key issue that will be analyzed is the extreme cost burdens on individuals in rented households, contrasted by their low income and inability to access proper facilities, influencing the 4 main household issues to The analysis of data, conclusion, and next steps taken will be issued through these 4 themes.

III. METHODS

The report utilizes secondary data collection and firsthand accumulation of preexisting datasets. The datasets used in this study are sourced from the U.S. governmental Office of Policy Development and Research in their American Community Survey (ACS). In total, 10 data sets were used to conduct the analysis.

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The following overarching parameters were used to collect datasets aligning with our purpose.

- Geographic Summary Level: National U.S.
- Year Selected: 2017-2021

The specific parameters used for collecting and organizing data were as follows:

A. Income Distribution (Used in Theme 3)

Parameter: Households categorized by income relative to HAMFI1

Filter: Data segmented by ownership status (owner, renter), and income level (<= 30%, >30% to <=50%, >50% to <=80% >80% to <=100% HAMFI)

B. Housing & Severe Housing Problems (Used in Themes 1 and 2)

Parameter: Households experience at least 1 of the identified problems (incomplete kitchen facilities, incomplete plumbing facilities, overcrowding, cost burden >30% or severe >50%)

C. Cost Burden (Used in Theme 4)

Parameter: Percentage of income spent and cost burden

Filter: Cost Burden is <= 30%, >30% to <=50%, >50%, segmented by income level or housing problem faced.

After collecting data, data cleaning was employed. Only relevant cases were included, missing or incomplete data was removed, and rows were organized by household type (renter, owner) or income. Descriptive charts and tables were generated to highlight trends and disparities, following the main 4 themes addressed in the Purpose page. The goal of the methodology was to capture and analyze the main trends to provide insights into the severity of the United States housing crisis and its impact on various income groups and housing tenure.

IV. RESULTS OF ANALYSIS

The 4 main housing problems are Incomplete Kitchen Facilities, Incomplete Plumbing Facilities, Overcrowding, and Cost Burden. Cost burden is the ratio of housing costs to household income. For renters- housing cost is gross rent (contract rent plus utilities). The normal burden is greater than 30%, while the severe cost burden is above 50%.

A. Theme 1: Housing Problems

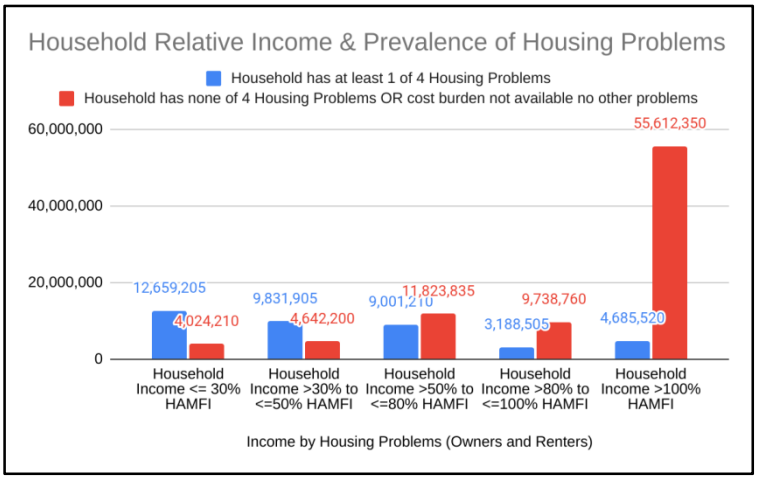
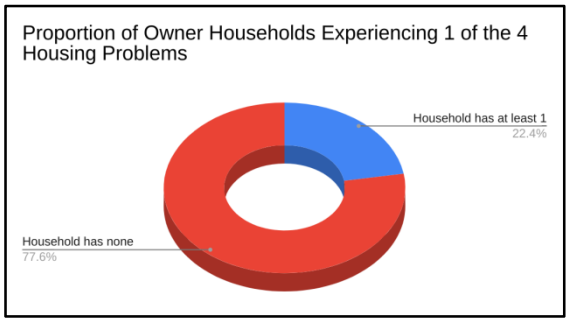
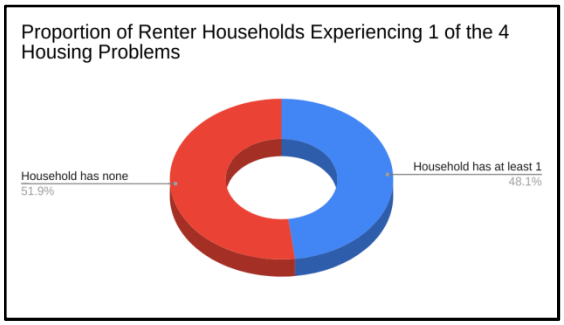


Figure 1: Graph of the relative income of a household in its jurisdiction to the number of housing problems it has.

Figure 1 displays that the most housing problems are in the least household income, and the trend pictured is as household income increases relative to other incomes in a jurisdiction, the amount of housing problems decreases. However, increasing household income may be challenging, as discussed on the Solution page, where the impoverished have job instability and limited mobility. At >100% HAMFI, only 4.7 million households report housing problems, compared to 12.6 million in the lowest income group, highlighting the direct correlation between economic status and housing stability.





Figures 2 (left) and 3 (right): Pie charts displaying the proportion of those experiencing at least 1 housing problem to those experiencing none. Figure 2 focuses on household-owning individuals, and Figure 3 focuses on renting individuals.

There is a large contrast between the partitioning of those experiencing household problems. Figure 2 displays how about ¼ of household-owning individuals experience housing problems, while Figure 3 shows how almost ½ of all renting households in the U.S. experience at least 1 housing problem. This illustrates the poor conditions of rented homes in the U.S., which contribute to health risks from a lack of sanitation, limited access to healthy food from a lack of a kitchen, and more negative effects from a lack of key facilities.

Income by Housing Problems (Owners and Renters)	Household has at least 1 of 4 Housing Problems	Household has none of 4 Housing Problems	Total
Household Income <= 30% HAMFI	12,659,205	4,024,210	16,683,430
Household Income >30% to <=50% HAMFI	9,831,905	4,642,200	14,474,150
Household Income >50% to <=80% HAMFI	9,001,210	11,823,835	20,825,040
Household Income >80% to <=100% HAMFI	3,188,505	9,738,760	12,927,285
Household Income >100% HAMFI	4,685,520	55,612,350	60,297,910
Total	39,366,375	85,841,415	125,207,785

Figure 4: Table of the income of owners, renters, and the number of housing problems they face

B. Theme 2: Severe Housing Problems

ıg Problems Overview	Owner	Renter	Total
s at least 1 of 4 Severe Housing	8,654,585	12,422,025	21,076,610
s none of the 4 Severe Housing	72,311,770	31,819,450	104,131,220
	80,966,310	44,241,465	125,207,785

Figure 5: Table displaying the households of owners and renters who face severe housing problems, and of households that don't face any.

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As seen in Figure 5, renters are more likely to face housing problems than house owners. Out of 44.2 million renters, 12.4 million (28%) face at least one severe housing problem. In contrast, only 8.6 million out of 81 million owners (11%) face a severe housing issue. On a national scale, nearly 17% of all households in the United States face a severe housing problem, which includes a lack of facilities, and above 50% cost burden, or income lost to housing costs.

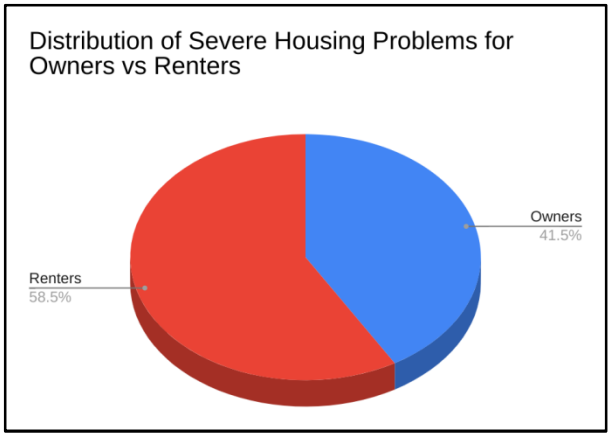


Figure 6: Pie Chart depicting the distribution of severe housing problems for owners vs. renters.

C. Theme 3: Income Distribution and Housing Problems

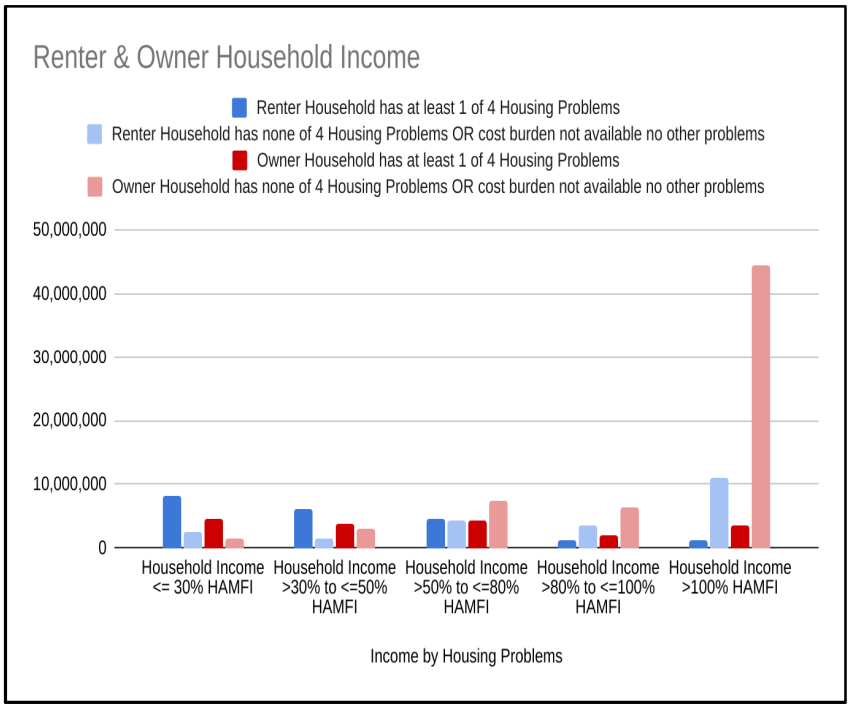


Figure 7: Bar graph of renter and household income, the number of households with this income, and whether these households face at least 1 housing issue.

Figure 7 displays how lower-income households face the most housing issues compared to other households in the same income level, which decreases as income increases. The highest concentration of housing problems is found at 30% of HAMFL (Housing and Urban Development Area Median Family Income). The graph also shows that even middle-income households of renters or owners face at least one or more housing problems. The lowest concentration of housing issues it at >100% HAMFL, where the amount of owners without any household issues goes from about 3 million to over 45 million.

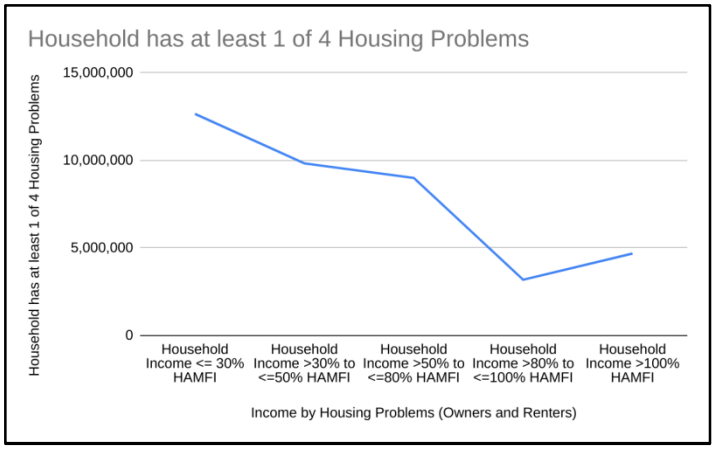


Figure 8: Amount of United States households that face at least 1 housing issue per their household income.

Figure 8 further highlights the need for policy reform in the United States. The disparity between household income and the amount of housing issues individuals face reinforces the need for policy change and displays how lower classes and the impoverished struggle under housing costs from a lack of income sources.

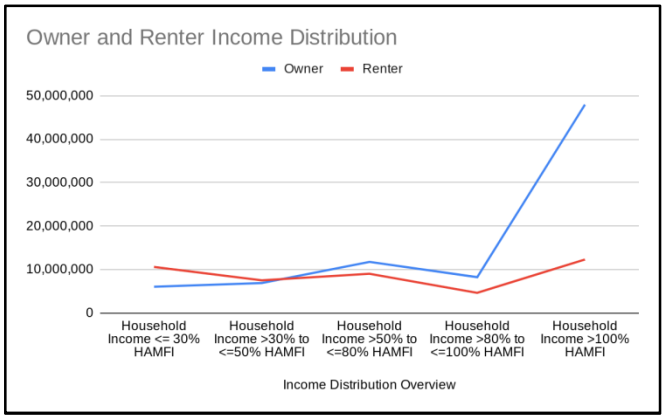


Figure 9: Household incomes of household renters and owners.

Renters have significantly lower incomes than owners, as seen in Figure 9. Many renters earn below 50% of the HAMFI, making it difficult to afford stable housing. Renting is often a necessity for lower classes, but rented housing is often in poor condition, keeping the impoverished in poverty from health and job risks.

D. Theme 4: Cost Burden

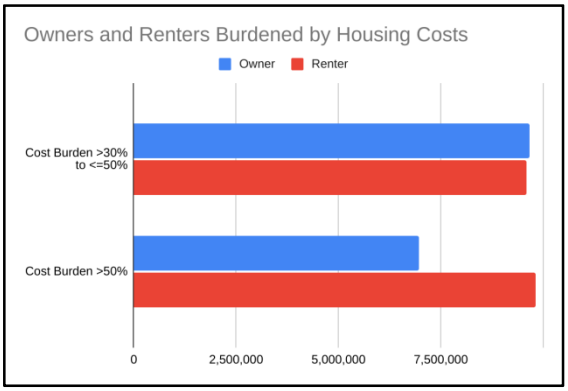


Figure 10: The amount of owners and renters burdened by housing costs from 30% to 50% of their household income, or severely above 50%.

Renters face a higher rate of cost burden as displayed in Figure 10, where the majority that face severe cost burden above 50% are renters. However, homeowners still face a cost burden, being the majority facing only from 3% to 50%.

ɔst Burden	Cost burden > 30%	Cost burden > 50%
come <= 30% HAMFI	7,950,835	6,664,700
come >30% to <=50% HAMFI	5,816,480	2,402,630
come >50% to <=80% HAMFI	4,114,095	618,990
come >80% to <=100% HAMFI	920,395	76,735
come >100% HAMFI	619,755	57,425

Figure 11: Table displaying the households' HAMFI relative to the cost burden they face.

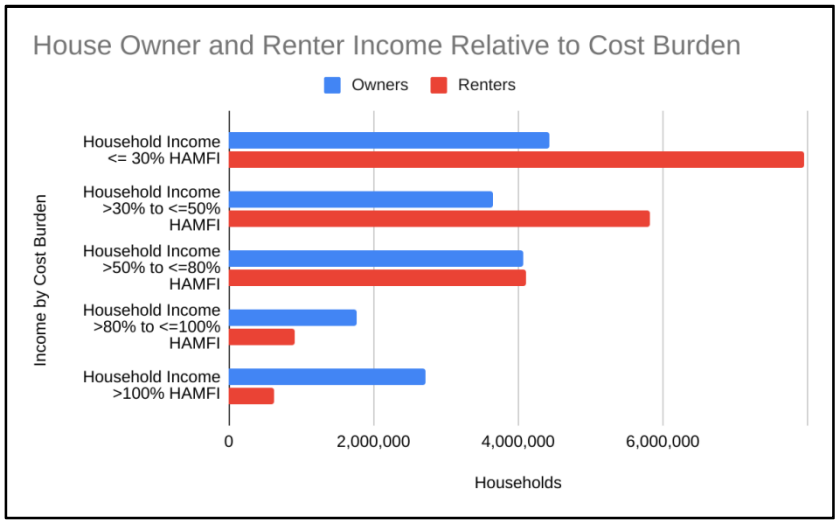


Figure 12: Bar graph displaying the income by cost burden of owner and renter households.

The data in Figure 12 highlights how different incomes experience housing affordability challenges, emphasizing the gap between renters and owners. Renters with the lowest income face the highest household income lost to cost burden, however, renters with the highest income face the lowest income lost to cost burden. As household income increases, renters face lower cost burdens, while there is not much of a correlation between owner and renter burden at each household income point. In the middle-cost burden, renters and house owners face almost the same cost burden at about 8 million households. Most households in the United States are at the low-income level, and renting households are about times more prevalent here than owned housing.

V. CONCLUSIONS

A. Housing Problems

The data indicate that housing problems, such as incomplete kitchen and plumbing facilities, overcrowding, and the cost burden, are disproportionately concentrated in low-income households. Nearly half of all house renters experience at least one housing problem. This report highlights the need for rental housing quality standards to ensure access to basic amenities.

B. Severe Housing Problems

Severe housing problems, where households face multiple housing issues and lose 50% of their income to housing costs, also impact renters more. When the impoverished are too deep into poverty, affordable housing is almost impossible to access. Improving economic ability may not even be an option due to the limited job opportunities, mobility, and instability associated with not having stable housing.

C. Income Distribution and Housing Problems

A direct relationship exists between income level, housing problems, and affordability. As income increases, housing problems decrease, and affordability increases. However, income increases were not the case for most households in the reported data from 2017 to 2021. Renters across all income levels face higher cost burdens than homeowners, signaling long-term economic disadvantages for those who cannot transition into home ownership.

D. Cost Burden

The cost burden data underscores that renters experience significantly higher financial strain than homeowners, regardless of their income level. The burden is more apparent for low-income households, where 50% of their income is lost to housing costs. The magnitude of cost burdens signals a systematic failure in national housing affordability. This increases homelessness, economic depression from job instability, and public health harm, ensuring the United States' health crisis economically and socially requires urgent policy reforms.

VI. NEXT STEPS

Utilizing the purpose of this report, which is to highlight the need for reform in the United States housing crisis, and the conclusions of the 4 main themes, it is clear that policy reform is the next urgent step. Reform is needed particularly by marginalized and impoverished communities and renters. The following reforms are aimed at deterring the discussed housing problems and fostering economic stability and affordability for households.

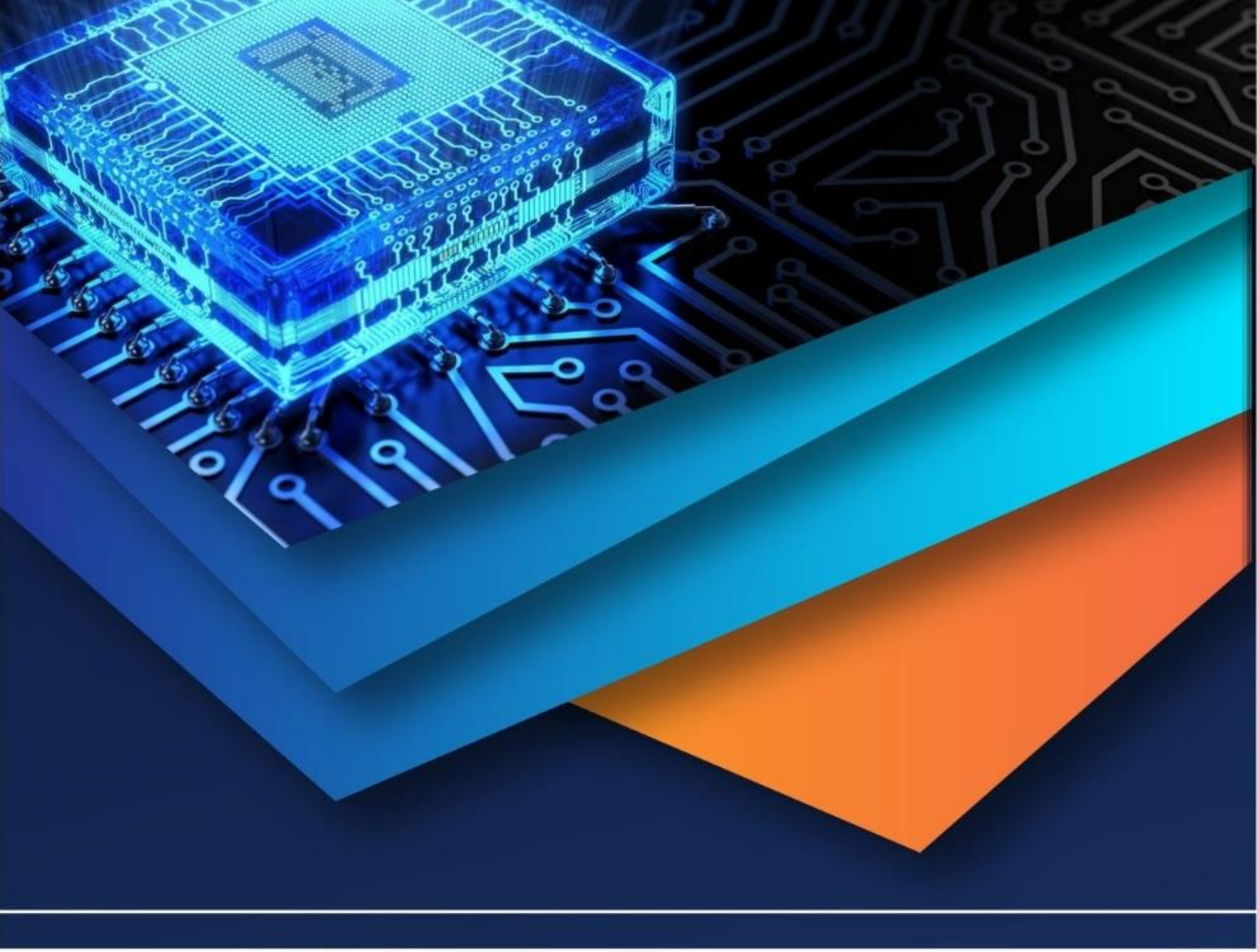
One key reform is to expand affordable housing programs and increase funding for them at the national and state levels. Implementation of this would include contracting private developers to build accessible housing, and supporting tax money to go further to the lower classes. By building new housing units, we decrease job instability associated with homelessness, growing the economy in a wave of employment. We also alleviate cost burdens on families, being able to decrease health risks associated with improper facilities in homes across the country.

Another reform is rent control policies, protecting renters from increases that are unaccounted for, leading to severe cost burdens and the further loss of household income. These policies would prevent constant migration and displacement, which would eventually lead to homelessness. Rent control promotes stability in set housing, maintaining affordability and mobility for jobs.

The next steps taken do not need to be simply housing reforms. The United States minimum wage could be set to increase, along with higher-paying job opportunities. This tackles cost burdens and the need to rent housing, promoting further access to essential facilities such as sanitation and plumbing to all individuals. Additionally, job training and development could aid the impoverished, who could provide proper work when adequately trained. This would allow the United States economy to rise, as well as the living wage of individuals to support better housing.

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