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INTERNATIONAL JOURNAL OF PROGRESSIVE RESEARCH IN ENGINEERING MANAGEMENT AND SCIENCE (IJPREMS)
(Int Peer Reviewed Journal)
Vol. 05, Issue 04, April 2025, pp : 2678-2688

e-ISSN : 2583-1062
Impact Factor : 7.001

HAS2MATE (AN ESTIMATION BASED APPLICATION FOR CIVIL ENGINEERS)

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DOI: https://www.doi.org/10.58257/IJPREMS40566

ABSTRACT

HAS2mate is a mobile application tailored for civil engineers to ease the process of estimation in construction tasks. Built using Flutter and Dart, it supports calculations for brickwork, concrete, plastering, paint, steel, and tile work. The app minimizes manual errors, enhances accuracy, and supports IS-codebased logic. Key features include dynamic theming, data persistence, and PDF export functionality. This cross-platform tool offers a scalable, time-saving solution for construction professionals and students alike. The project combines practical engineering needs with technological innovation, aiming for wider realworld applicability and user adoption.

Keywords: Estimation, Civil Engineering, Flutter, IS Codes, Construction Management, Mobile Application.

1. INTRODUCTION

HAS2mate is a powerful and user-friendly mobile application designed specifically for civil engineers, contractors, and construction professionals. Built using Flutter, Google's open-source UI toolkit for crafting natively compiled applications, HAS2mate provides quick and accurate estimations for various construction-related calculations. Flutter ensures a smooth, responsive, and visually appealing experience across both Android and iOS platforms, making the app accessible to a wide range of users. The app simplifies complex civil engineering computations, offering dedicated modules for brickwork, plastering, tile quantity, steel quantity, concrete volume, and paint estimation. Whether you're planning a small renovation or a large-scale construction project, HAS2mate helps streamline calculations, reduce manual errors, and save valuable time. With its intuitive interface and precise algorithms,

HAS2mate is an essential tool for professionals seeking efficiency and reliability in their day-to-day work. By leveraging Flutter's cross-platform capabilities, HAS2mate delivers a seamless experience with fast performance and customizable features, ensuring that users can perform calculations on the go with ease.

Whether you're on-site or in the office, HAS2mate is your go-to estimation companion for all civil engineering needs.

Key Highlights

- Fast and responsive performance across Android and iOS.
- Simplifies major civil estimation tasks like brickwork and plastering.
- Reduces manual errors and saves on-site time.
- Clean, intuitive interface with dynamic theming.
- Stores and exports previous calculations for future use.

Supported Calculation Modules

- Brickwork estimation.
- Plastering quantity calculation.
- Tile quantity and layout.
- Steel bar estimation.
- Concrete volume estimation.
- Paint coverage and cost calculation.

2. LITERATURE REVIEW

1. Daniel W. Halpin (2012)

He is a leading expert in construction management, particularly in project scheduling, risk management, and construction process modeling. He authored *Construction Management: Theory and Practice*, a widely used resource.

Halpin's research bridges theory and practice, focusing on simulation techniques and their application to enhance project management and construction productivity.

Bolivar A. Senior (2012)

He is the co-author of *Construction Management* with Halpin, specializes in construction project management, focusing on cost control and resource allocation. His work integrates managerial principles with technical aspects, providing valuable insights for construction engineering

2. Peter W. G. Morris (2007)

He was a distinguished professor at University College London and a leading figure in project management. He authored *The Anatomy of Major Projects* and co-edited *The Wiley Guide to Managing Projects*. His research focused on strategic project management, integrating technical and organizational elements for effective project delivery.

Jeffrey K. Pinto (2007)

He is a professor at Pennsylvania State University specializing in organizational project management. He co-authored *The Wiley Guide to Managing Projects* with Morris and has received several PMI awards for his contributions to the field, focusing on project planning and execution.

3. Robert L. Peurifoy (2014)5

He was a renowned civil engineer and educator, known for his contributions to construction management. He taught at the University of Texas and Texas A&M University and authored influential texts such as *Construction Planning, Equipment, and Methods*. His work focused on practical aspects of construction engineering, and his legacy is honored by the American Society of Civil Engineers with an award in his name.

Garold D. Oberlender (2014)

He is Professor Emeritus at Oklahoma State University, specializing in construction and project management. With over 40 years of experience, he co-authored key texts like *Estimating Construction Costs*, focusing on practical strategies for cost estimation and management.

4. Autodesk (1982)

It provides software solutions for the construction industry, including Autodesk

Construction Cloud, which integrates cost management features to help teams track and control project expenses. This cloud-based platform enhances collaboration, offering tools to monitor subcontractor costs, manage payments, and streamline expense management, while also forecasting costs, tracking risks, and improving cash flow and profitability projections.

5. WinEst (1992)

It was developed by Trimble, is a cost estimating software for construction projects, known for its user- friendly interface that mimics Microsoft Excel. It offerspowerful databasedriven tools that allow users to customize work-breakdown structures, estimate templates, and incorporate labor and equipment rates. WinEst improves estimating accuracy and efficiency, making it suitable for a range of users from small builders to large contractors.

6. William R. Mincks (2015)6

Published in the International Journal of Construction Education and Research, Mincks specializes in construction workforce development and productivity analysis. His work focuses on labor estimation techniques and their impact on project scheduling, particularly in commercial construction projects.

Hal Johnston (2015)

Co-author with Mincks, Johnston's research in the Journal of Construction Engineering and Management examines the relationship between project complexity and cost overruns, developing predictive models for risk assessment in large-scale infrastructure projects.

7. Simaan AbouRizk (2016)

Featured in Automation in Construction, AbouRizk pioneered simulation-based construction planning methods. His work integrates discrete-event simulation with building information modeling (BIM) to improve accuracy in duration and cost estimates for industrial projects.

Yongwei Shan (2016)

Published in the Journal of Management in Engineering, Shan's research focuses on data-driven construction safety analytics and their influence on project cost estimation, particularly in high-risk work environments.

8. Irtishad Ahmad (2017)

Appearing in Construction Innovation, Ahmad developed frameworks for knowledge-based cost estimation systems. His work helps automate preliminary estimates through case-based reasoning and historical data mining.

Giovanni C. Migliaccio (2017)

Published in the Engineering, Construction and Architectural Management journal, Migliaccio7 advanced lean construction principles in estimating processes, reducing waste in project budgeting through pull-planning techniques

9. Weiwei Chen (2018)

Featured in Advanced Engineering Informatics, Chen created machine learning algorithms for conceptual cost estimation, particularly effective in early project phases where data is limited.

Jochen Teizer (2018)

Published in Automation in Construction, Teizer's work on real-time project monitoring systems integrates IoT sensors with earned value management for dynamic cost control.

10. Rafael Sacks (2019)

Appearing in Construction Management and Economics, Sacks developed BIM-based quantity takeoff methods that reduce manual measurement errors in estimates by 30-40%.

Hubo Cai (2019)

Published in Journal of Computing in Civil Engineering, Cai's research focuses on augmented reality applications for field measurement and their impact on reducing rework costs.

11. Fernanda Leite (2020)

Featured in Journal of Construction Engineering and Management, Leite created integrated project delivery (IPD) cost models that align estimator inputs with designer decisions through cloud -based collaboration platforms.

Ken-Yu Lin (2020)8

Published in Engineering, Construction and Architectural Management, Lin's work examines cultural factors in multinational project teams and their influence on cost estimation accuracy.

Carol C. Menassa (2021)

Appearing in Automation in Construction, Menassa developed life-cycle cost analysis frameworks that incorporate energy performance data into construction estimates for sustainable buildings.

Xinghua Gao (2021)

Published in Advanced Engineering Informatics, Gao created blockchain-based solutions for transparent cost tracking in public infrastructure projects, reducing payment disputes.

3. METHODOLOGY

The development methodology included UI design, market survey, learning Excel and Microsoft Project for planning, and analyzing competing software. Flutter was selected for development due to its crossplatform capability and hot-reload feature. Steps included design finalization, coding, IS code integration, and final testing.

Steps Taken During Project Development:

- UI Design:

We are designing the user interface (UI) with assistance from a programmer.

- Market Survey:

We conducted a market survey to analyze labor and material rates.

- Excel Proficiency:

We thoroughly learned Microsoft Excel for calculations and data input.

- Schedule Planning:

We are using Microsoft Project (MSP) for activity scheduling and estimating the completion period.

- Competitor Analysis:

We explored similar apps in the market to gather inspiration for building our software on a minimal budget without compromising performance.

- Cost-Effective Development:

We are exploring free programming software options to keep the project low-cost.

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4. MODELING AND ANALYSIS

HAS2mate was implemented using Flutter and Dart. The app uses Shared Preferences for persistent data storage and features six modules: brickwork, concrete, plastering, paint, steel, and tile calculations. Each module uses standard engineering formulas with customizable input, providing users with both flexibility and accuracy.

5. RESULTS AND DISCUSSION

The app successfully integrates estimation modules with IS-code compliance (e.g., IS 1200, IS 3389, IS 456, etc.). It supports export to PDF and persistent local storage, with theming options for user preference.

Visual outputs include user interfaces for each calculation type, enhancing usability.

6. CONCLUSION

HAS2mate serves as an efficient and user-friendly solution for civil engineers and construction professionals, delivering precise estimations for key calculations such as brickwork, plastering, steel quantity, and more. By combining an intuitive interface with reliable algorithms, the app enhances productivity and minimizes manual errors in project planning. Key features, including customizable inputs, real-time adjustments, and detailed breakdowns, ensure adaptability to different construction scenarios. While initial adoptionmay require some familiarization, especially for users transitioning from traditional methods, these challenges can be overcome with proper guidance and future updates. Overall, HAS2mate has the potential to significantly improve accuracy, efficiency in construction-related calculations, making it an indispensable tool for industry professionals. Moving forward, the focus will be on gathering user feedback, optimizing performance, and expanding features to cater to a wider range of engineering needs.

Key Takeaways:

Precise Calculations:

Provides exact calculations for key construction activities, such as brick laying, plastering, steel measurement, and concrete volume, for effective project planning.

Improvement in Efficiency:

Employs enhanced algorithms to minimize human errors, automate workflows, and reduce time spent on

redundant calculations, enhancing overall productivity.

Dynamic Inputs:

Facilitates dynamic modification of input parameters, providing flexibility to accommodate various construction situations and individual project needs.

Future Development:

Emphasis on ongoing performance improvement, integration of user feedback, and feature extension to meet a wider range of engineering requirements and enhance usability.

ACKNOWLEDGEMENTS

It is our privilege to express our sincerest regardsto our project guide, MR. DANISHSAYYED SIR,four their valuable input, able guidance, encouragement, wholehearted corporation and constructive criticism throughout the duration of our project. We deeply express our sincere thanks to our head of department

MS. RUPALI MA'AM, for encouraging and allowing us to present the project on the topic "HAS2mate (AN ESTIMATION BASED APPLICATION FOR CIVIL ENGINEERS)". At our department premises for the partial fulfillment of the requirement leading to the award of DIPLOMA CERTIFICATE.We take this opportunity to thank all our lecturers who have directly or indirectly help our project. We pay our respect and love to our parents and all other family members and friends for their love and encouragement throughout our career. Last but not the least we express our thanks to our friends for their cooperation and support.

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