SOLAR PANEL COST ESTIMATOR

A PROJECT REPORT

Submitted by

PREM KUMAR D (220701204)

in partial fulfillment for the course

OAI1903 - INTRODUCTION TO ROBOTIC PROCESS AUTOMATION

for the degree of

BACHELOR OF ENGINEERING

in

COMPUTER SCIENCE AND ENGINEERING

RAJALAKSHMI ENGINEERING COLLEGE
RAJALAKSHMI NAGAR
THANDALAM
CHENNAI – 602 105

NOVEMBER 2024

RAJALAKSHMI ENGINEERING COLLEGE

CHENNAI - 602105

BONAFIDE CERTIFICATE

Certified that this project report **"Solar panel cost estimator"** is the bonafide work of **"PREM KUMAR D (2116220701204)"** who carried out the project work for the subject OAI1903 - Introduction to Robotic Process Automation under my supervision.

DR. N Duraimurugan
SUPERVISOR
Assistant Professor
(SG), Department of
Computer Science and
Engineering, Rajalakshmi
Engineering College,
Rajalakshmi Nagar
Thandalam, Chennai – 602105.

Submitted to Project and Viva Voce Examination held on _____.

Internal Examiner **External Examiner**

ABSTRACT

"The Solar panel cost estimator " is an innovative Robotic Process Automation (RPA) aims to streamline the process of solar panel cost estimation. By leveraging web scraping techniques, the system efficiently gathers real-time data on electricity costs and solar panel pricing. Users are prompted to input their current monthly electricity expenditure and specify whether the installation is for commercial or residential use. Additionally, the user's state of residence is required to accurately calculate regional incentives and subsidies. The system then processes this information to generate a comprehensive cost-benefit analysis. This analysis includes the monthly and daily savings of the user who are using the traditional way of getting electricity, along with the implementation cost for this project. This project is a step towards promoting to use the renewable source of energy on everyday basis. With the help of this automation they they get the data in the excel sheet and the user can use it for their future comparison process and by sending the data through the email.

ACKNOWLEDGEMENT

Initially we thank the Almighty for being with us through every walk of our life and showering his blessings through the endeavour to put forth this report. Our sincere thanks to our Chairman **Mr. S. Meganathan, B.E, F.I.E.,** our Vice Chairman **Mr. Abhay Shankar Meganathan, B.E., M.S.,** and our respected Chairperson **Dr. (Mrs.) Thangam Meganathan, Ph.D.,** for providing us with the requisite infrastructure and sincere endeavouring in educating us in their premier institution.

Our sincere thanks to **Dr. S.N. Murugesan, M.E., Ph.D.,** our beloved Principal for his kind support and facilities provided to complete our work in time. We express our sincere thanks to **Dr. P. KUMAR, M.E., Ph.D.,** Professor and Head of the Department of Computer Science and Design for her guidance and encouragement throughout the project work. We convey our sincere and deepest gratitude to our internal guides, **Mr. B Bhuvaneswaran, M.E.,** Assistant Professor (SG), **Ms. J Jinu Sophia, M.E.,** Assistant Professor (SG), Department of Computer Science and Engineering, Rajalakshmi Engineering College for their valuable guidance throughout the course of the project. We are very glad to thank our Project Coordinators, **Dr. N. Durai Murugan, M.E., Ph.D.,** Associate Professor, Department of Computer Science and Engineering for their useful tips during our review to build our project.

PREM KUMAR D(220701204)

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF ABBREVIATIONS

ABBREVIATION	ACCRONYM
RPA	Robotic Process Automation
AI	Artificial Intelligence
API	Application Programming Interface
CV	Computer Vision
OCR	Optical Character Recognition

CHAPTER 1

INTRODUCTION

1. INTRODUCTION

In an era marked by increasing energy consumption and environmental concerns, the adoption of sustainable energy solutions has become paramount. Solar energy, harnessed from the abundant sunlight, offers a promising avenue to reduce reliance on traditional fossil fuels and mitigate climate change. However, the initial investment and complex calculations involved in solar panel installation can often deter potential adopters. To bridge this gap and empower individuals and businesses to make informed decisions, we present a comprehensive Robotic Process Automation (RPA) project designed to streamline the solar panel cost estimation process.

Leveraging the power of web scraping, this project automates the collection of real-time data on solar panel prices, government incentives, and regional electricity rates. By integrating this data with user-provided information such as annual electricity consumption and location, the RPA bot can accurately calculate potential savings, payback periods, and overall system costs. This automation not only saves time and effort but also ensures precision and consistency in the calculations.

Furthermore, the project incorporates a user-friendly interface that allows users to easily input their specific requirements. Once the data is processed, the bot generates detailed reports, including a breakdown of costs, projected savings, and a comparative analysis of different solar panel configurations. These reports can be customized to cater to the needs of both residential and commercial users.

By automating the complex calculations and data gathering processes, this RPA project aims to make solar energy more accessible and affordable. It empowers individuals and businesses to evaluate the economic viability of solar panel installations and take informed decisions towards a sustainable future.

UiPath's main product is the UiPath Automation Platform. The platform combines a family of low-code visual integrated development environment (IDE) products called Studio for process creation, with client- side agents called Robots that execute those processes.

2. OBJECTIVE

The primary objective of “The Solar panel Cost Estimator " is to increase the usage of renewable source By leveraging Robotic Process Automation (RPA), the project aims to automate the process of estimating the cost required required for the implementation cost of the solar panel and helps the user to check the beneficiary part by understanding how much the user will save on their monthly basis

3. EXISTING SYSTEM

Traditionally, estimating the cost of a solar panel system has been a complex and time-consuming process. It often involves manual calculations, data gathering from various sources, and the use of spreadsheets or basic online calculators. These methods are prone to human error, require significant expertise, and may not provide accurate or up-to-date information.

4. PROPOSED SYSTEM

To overcome the limitations of traditional methods, we propose an innovative RPA-based system that leverages web scraping to automate data collection and analysis. This system is designed to provide accurate and personalized solar panel cost estimates efficiently by the getting the inputs such as the location the user wants to implement this including the cost of the electricity bill the user is paying for every method in the traditional method along with the category such as for the residential or a commercial purpose. By getting the input parameters it will direct to the government aided website which is a solar rooftop calculator which gives the detailed analysis of the input and provide with how much KWh of energy can be

saved per day and the cost of this saving including how much it will cost to implement this project. By this the user can have a a detailed analysis of the savings and also the user can send this to their respective email.

CHAPTER 2

LITERATURE REVIEW

1. Survey on Robotic Process Automation (RPA) in Solar Panel:

Global warming is on of the very concerned global problems in the modern era. The main cause of this problem is an excess of greenhouse gases in the atmosphere. The most influenced gas is carbon dioxide, which has the mostradiative forcing Hence, renovating conventional activities to low-carbon dioxide emission ones are big influence. From [2], the most carbon dioxide emission come from electricity and heat production sector, transportation sector, and industrial sector respectively. Thus, changing conventional electricity generation to low-carbon generation is the solution. With a big growth in low-carbon generation,photovoltaics (PV) demand has increased significantly. The PV generation has globally grown over 10 times since the past decade [3], which makes PV manufacturers need to produce more efficient solar panels to meet this demand. Therefore, adopting new technologies such as robotic automation and sensors is a key factor of the manufacturers. Robot is the automation which uses physical machines to achieve tasks. It helps industries work faster, more precise, which inexhaustibility. This helps increase manufactures' productivity and efficiency. Robots are used in many sectors including solar panel manufacturing. There are several types of robot using in industries. Each type has its specific advantages hence we should use it wisely. This essay will state about the process of solar panel manufacturing.

2. The Energy Sector Digitalisation

The increasing use of information and communication technology (ICT) in various social, economic, industrial, and cultural sectors is at the origin of the so-called phenomenon of digital disruption, which currently also involves more and more behaviour of individuals in every part of the world and that, according to Skog and co-authors' analysis, has to be interpreted in terms of a creative and, at the same time, destructive process that crosses every socio-economic sector . Even if in a more gradual manner, according to Lea Myllykallio in , this is now occurring, with visible effects, in the energy sector, where the effective strong support of the pervasive and relevant use of digital technologies can be said to have actually been accelerated by the recent increasing and large adoption of renewable energies in the energy mix of most Western countries. According to the IEA world outlook 2022, renewable energy use worldwide increased from about 15% in 2010 to 20% in 2020 and is now expected to overcome 60% in the 2050 mix. Beyond the well-known environmental benefits, the most important change related to the massive use of renewable energies for electricity production is connected to the unavoidable changes in the energy trading methods as a result of their production variability due to intrinsic and site-specific weather condition forecast uncertainty. Although this issue has greatly advanced in terms of accuracy over time, it still has an intrinsic level of volatility increasing as the time horizon increases. This has led to the introduction of a growing level of complexity in the management of energy markets, which has, in turn, forced and increasingly obliged the involved stakeholders (TSOs, producers, distributors, etc.) to move financial transactions related to this type of energy to closer and closer time horizons, such as the day-after market and, increasingly too, even the intraday market, with negotiations that tend to be increasingly characterized by correspondingly short time horizons of even just a few minutes. It is clear that this type of financial market can only operate digitally, and it is also clear that as the penetration of renewable energy in a country's energy mix increases, this type of operational methodology will become

increasingly relevant. It is important to underline that the development of blockchain technologies has been and is functional within this context, and that without which, in fact, the certified volumes of energy that transactions handle would not be able to be exchanged, especially in a market increasingly made up of prosumers .

3. Summary of the intersection of RPA And Solar Energy Checks:

“Robotic Process Automation (RPA) is poised to revolutionise the solar panel industry. By automating repetitive, rule-based tasks, RPA can significantly boost efficiency, accuracy, and customer satisfaction.From the initial stages of customer onboarding to the final stages of project completion and after-sales service, RPA can streamline operations. For instance, it can automate data entry, lead qualification, and generating customised quotes. In project management, RPA can optimise resource allocation, schedule site visits, and generate progress reports. Moreover, RPA can streamline financial operations, such as invoice processing and financial reporting. In customer support, RPA can handle routine inquiries, schedule technician visits, and provide timely updates. By automating these tasks, solar companies can reduce operational costs, improve accuracy, and enhance customer satisfaction. This allows them to focus on strategic initiatives, such as innovation and market expansion.

CHAPTER 3

SYSTEM DESIGN

1. SYSTEM CLASS DIAGRAM

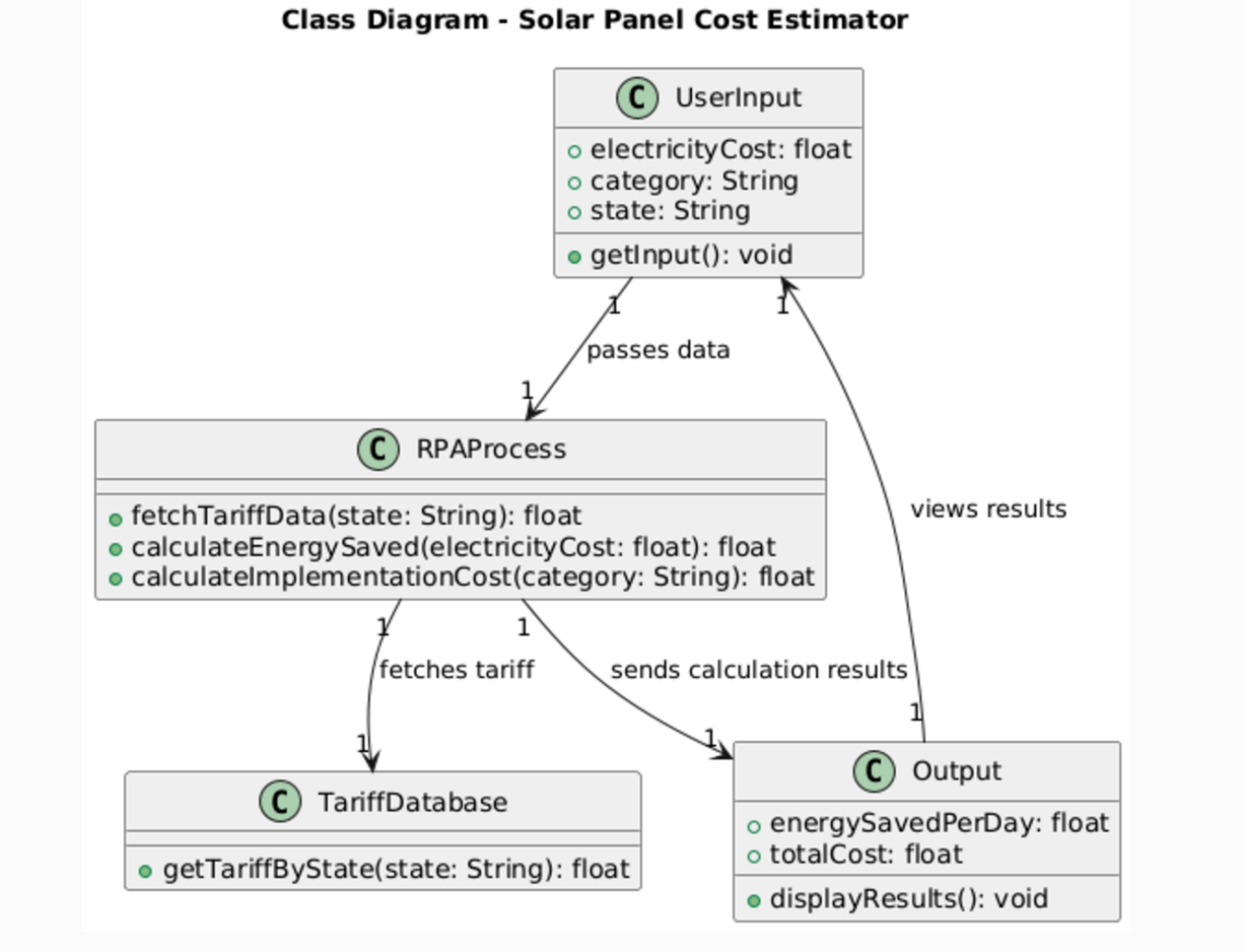


Fig 3.1 System Flow Diagram

2. ARCHITECTURE DIAGRAM

An architecture diagram is a graphical representation of a set of concepts, that are part of an architecture, including their principles, elements and components. The architecture diagram for this project is in Fig. 3.2.

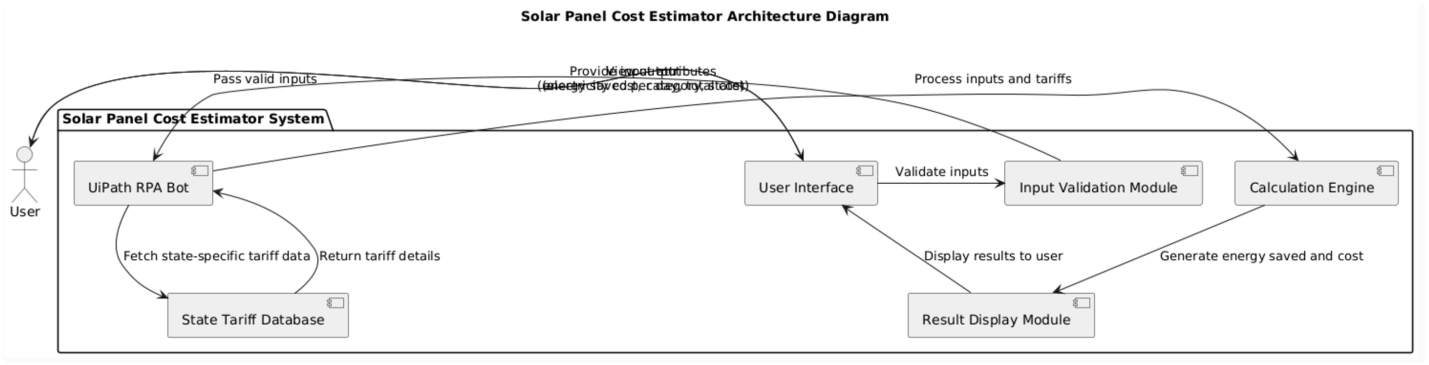
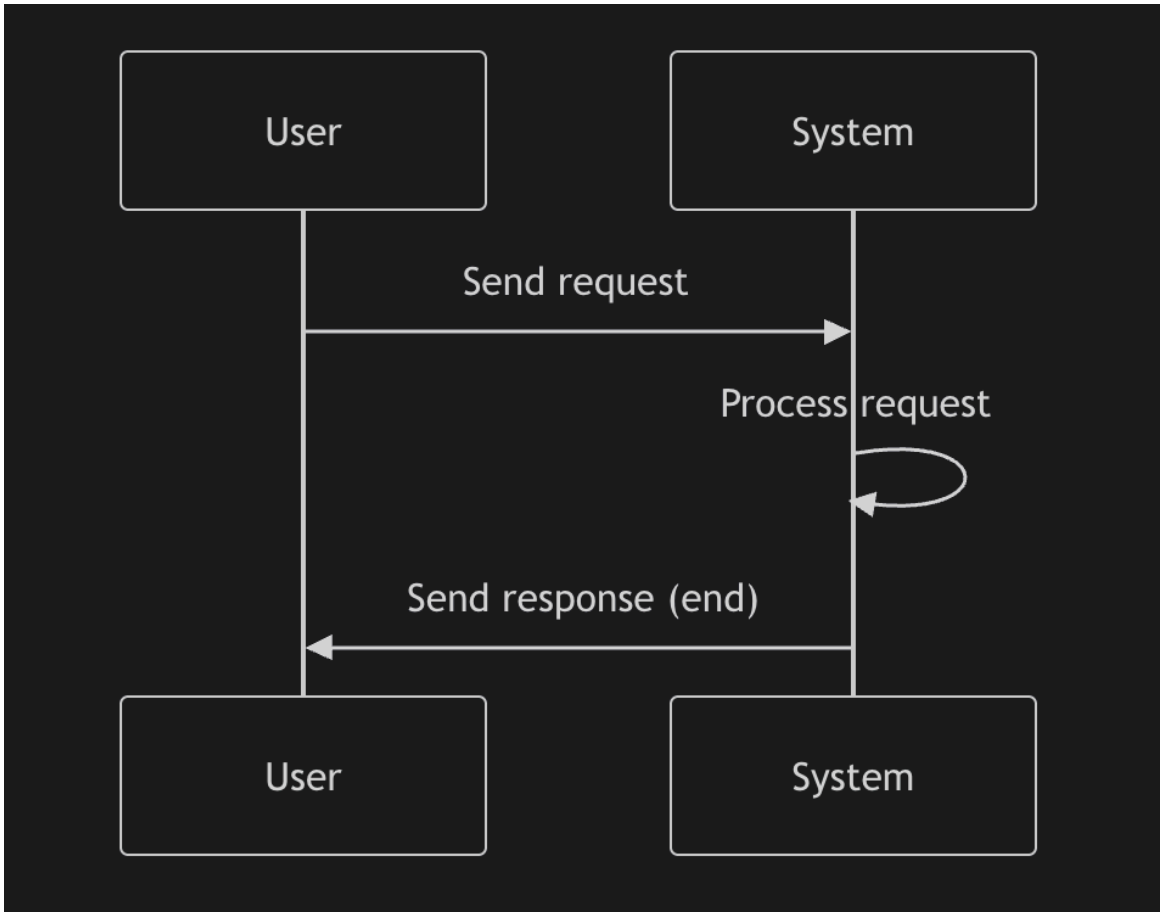


Fig 3.2 Architecture Diagram

3. SEQUENCE DIAGRAM

A sequence diagram is a type of interaction diagram because it describe and s how in what order a group of objects works together. The sequence diagram for this project is in Fig. 3.3.

Fig 3.3



Sequence Diagram

CHAPTER 4

PROJECT DESCRIPTION

This project aims to develop an RPA-powered tool to streamline the process of solar panel cost estimation. By automating data collection, calculations, and report generation, this tool will significantly reduce manual effort and improve accuracy.

Module 1: User Input Module

User Interface: Design a user-friendly interface to capture essential information:

- Annual or monthly electricity consumption
- State of residence
- Purpose of installation (residential or commercial)

Data Validation: Implement validation checks to ensure accurate input.

Module 2: Data Collection Module

Web Scraping: Utilize web scraping techniques to extract real-time data from reliable sources:

- Solar panel prices
- Electricity savings per day in rs
- Electricity savings in KWh
- Installation costs

Module 3 : Exporting to excel

Systematically update the Excel report with assessment results.

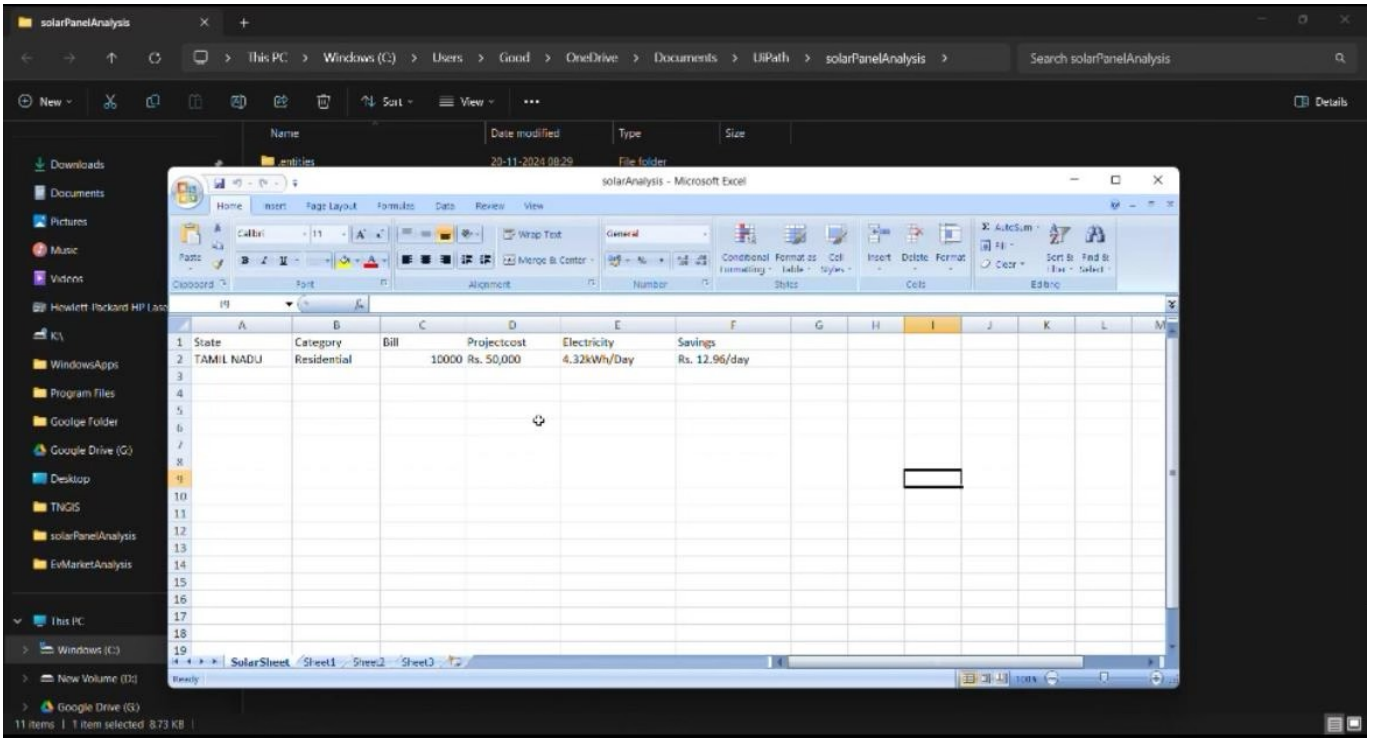
Module 4 : Sending in email :

Systematically now with the help of outlook send the report in email

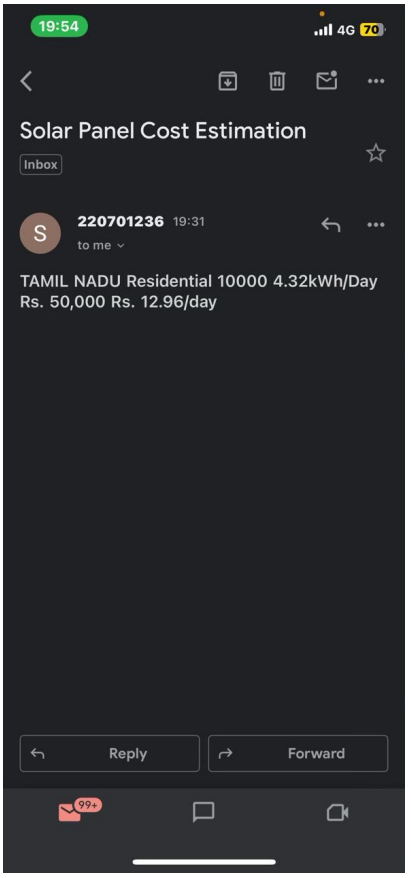
CHAPTER 5

OUTPUT SCREENSHOTS

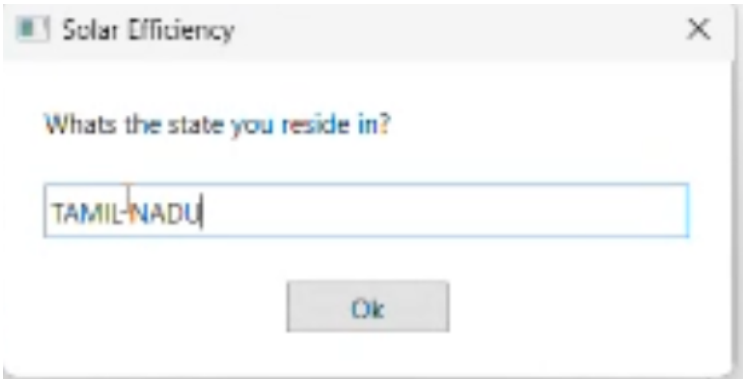
EXCEL SHEET REPORT

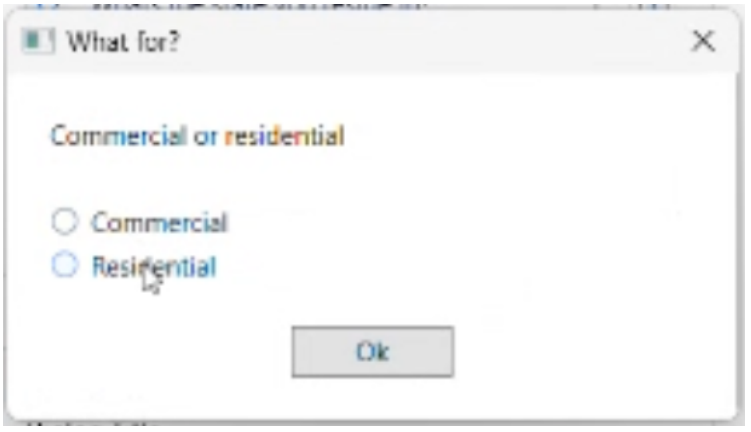


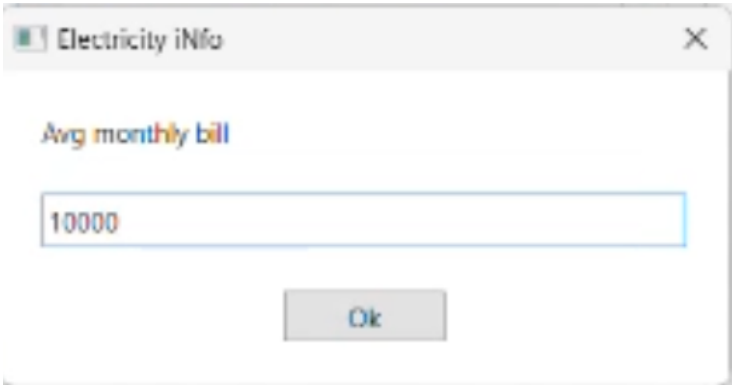
OUTPUT IN GMAIL



INPUT DIALOG BOX







CHAPTER 6

CONCLUSION

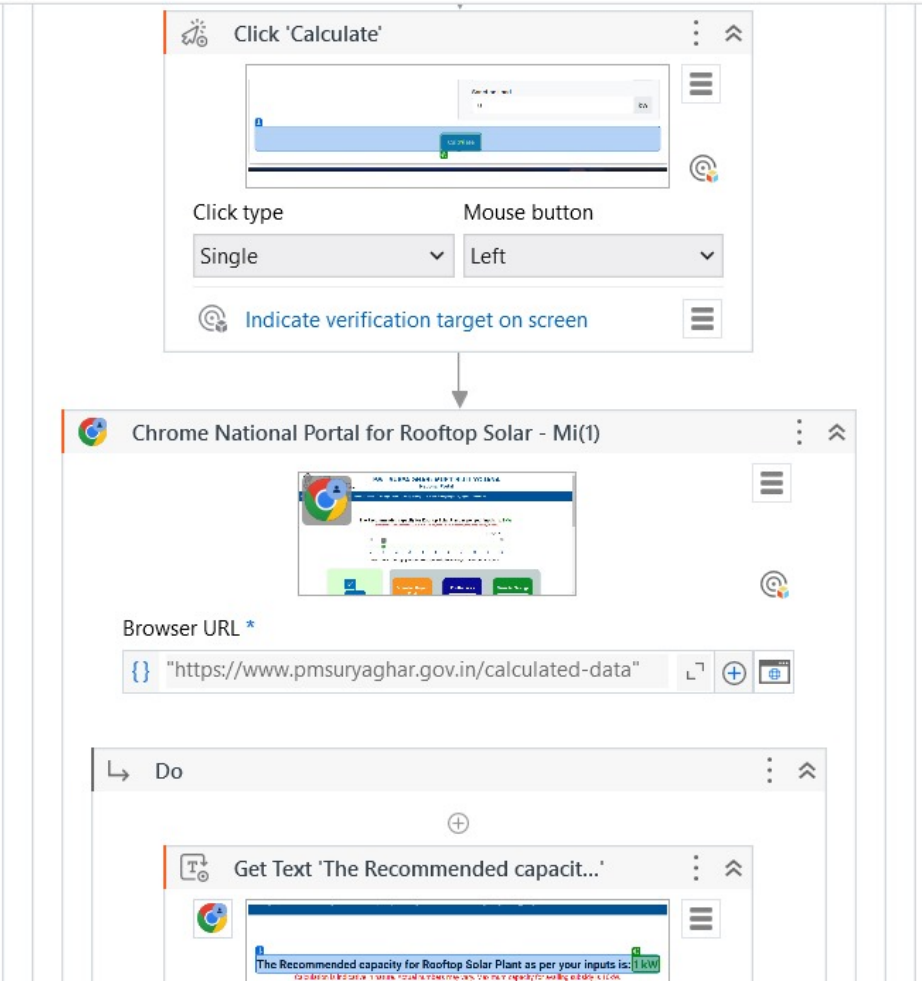
In conclusion, the proposed RPA-based solar panel cost estimation system offers a significant advancement in the solar energy industry. By automating the complex process of data collection, analysis, and report generation, this system empowers both businesses and individuals to make informed decisions regarding solar panel installations.

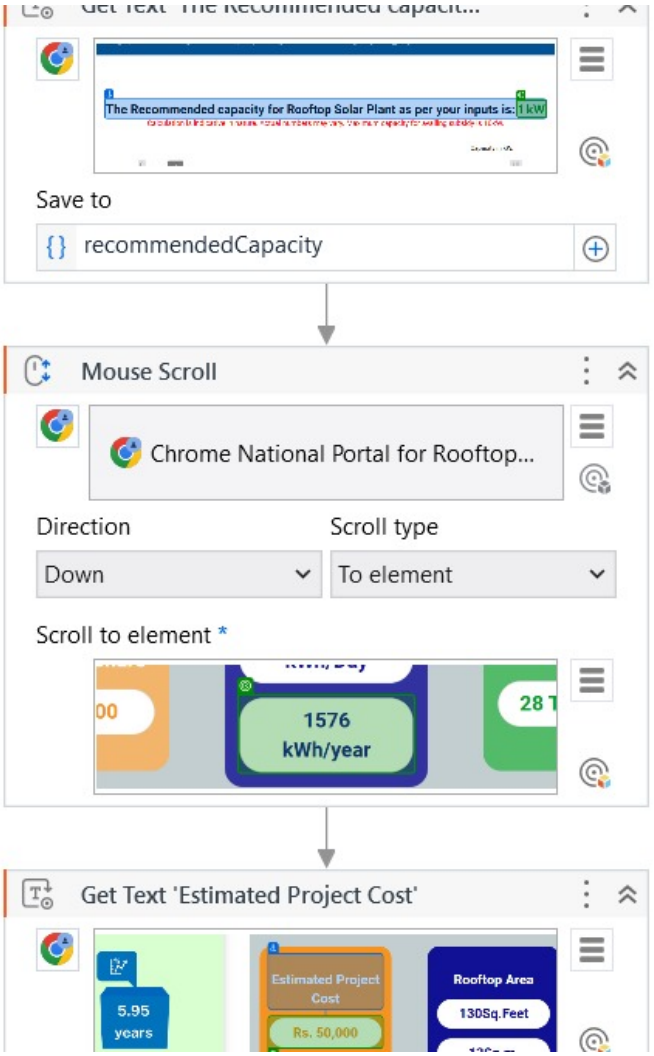
The system's ability to provide accurate and personalized cost estimates, coupled with its user-friendly interface, simplifies the decision-making process. By reducing manual effort and eliminating human error, the system enhances efficiency and saves valuable time.

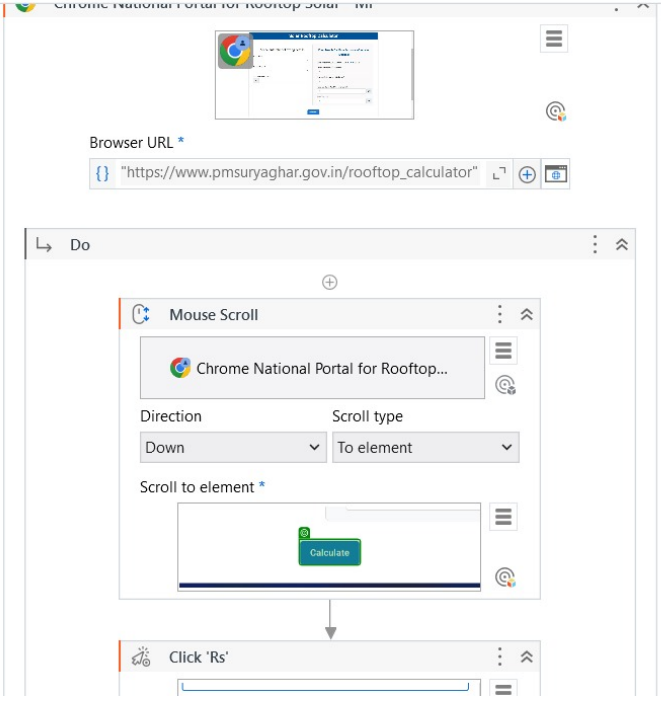
As the demand for sustainable energy solutions continues to grow, this RPA-based system positions itself as a valuable tool for promoting the adoption of solar energy. By making the process of solar panel cost estimation more accessible and efficient, it contributes to a greener and more sustainable future.

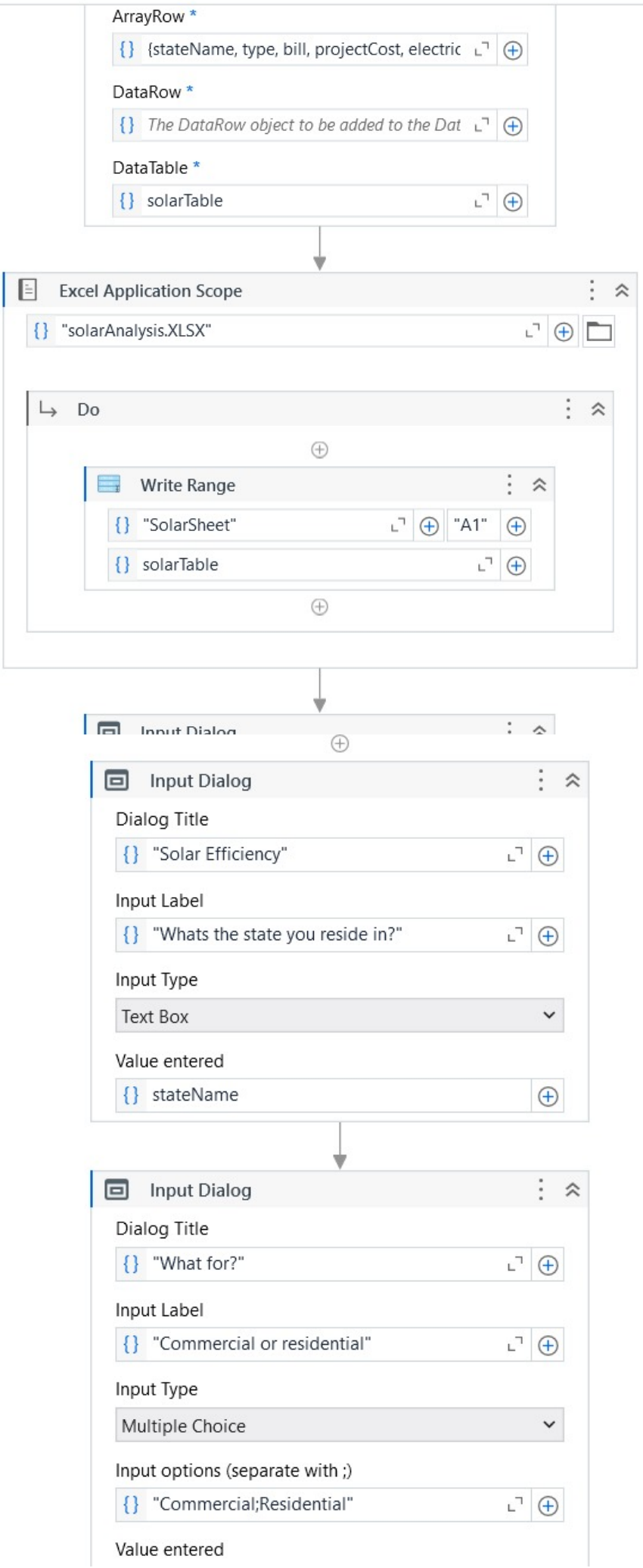
APPENDIX

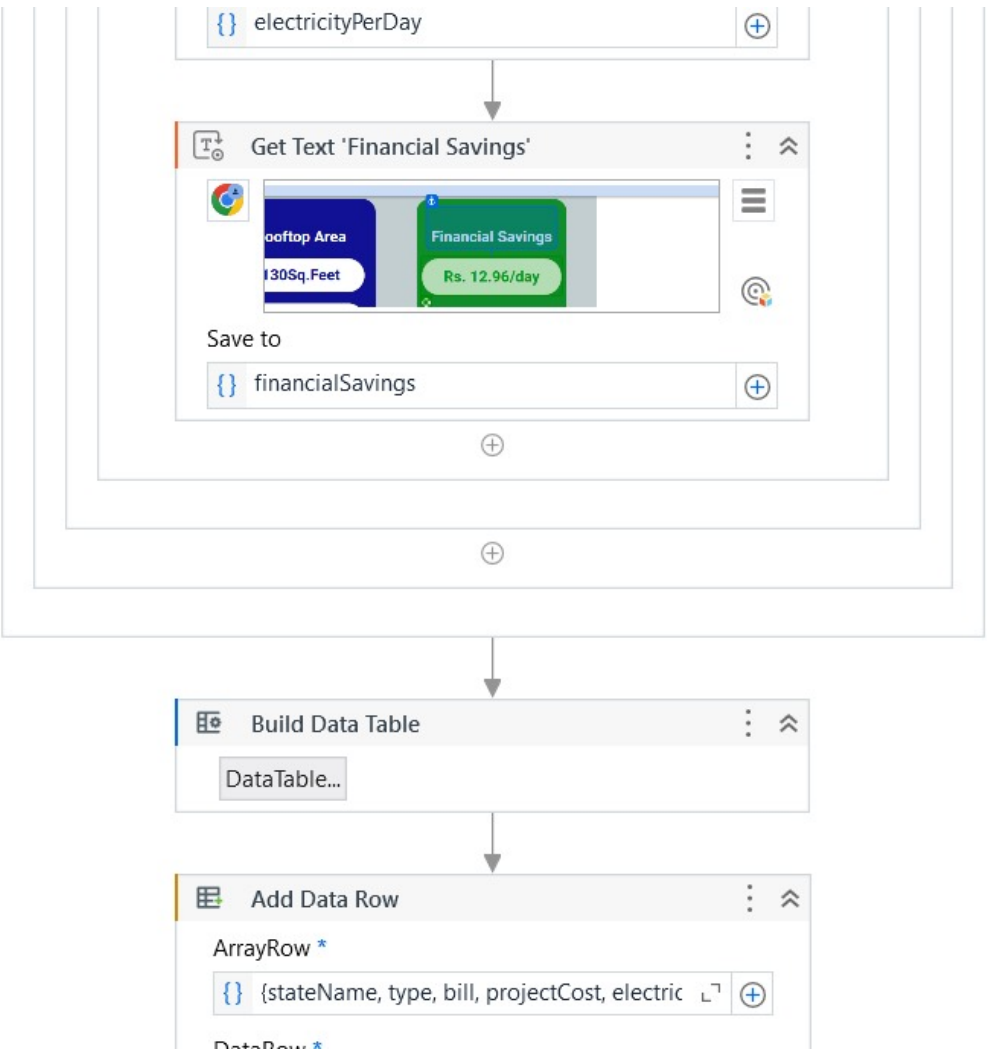
PROCESS WORK FLOW

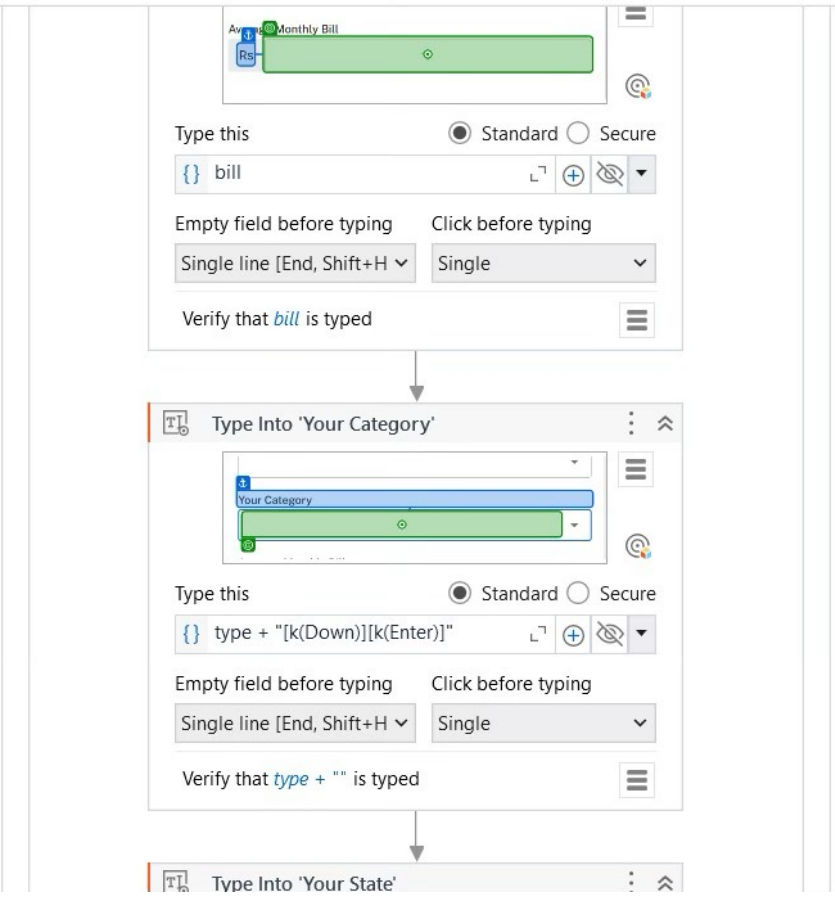



The Recommended capacity for Rooftop Solar Plant as per your inputs is: 1 kW
Save to
recommendedCapacity
Mouse Scroll
Chrome National Portal for Rooftop...
Direction
Down
Scroll type
To element
Scroll to element *
1576
kWh/year
Get Text 'Estimated Project Cost'
5.95
years
Estimated Project Cost
Rs. 50,000
Rooftop Area
130Sq.Feet


Browser URL *
"https://www.pmsuryaghar.gov.in/rooftop_calculator"
Do
Mouse Scroll
Chrome National Portal for Rooftop...
Direction
Down
Scroll type
To element
Scroll to element *
Calculate
Click 'Rs'


ArrayRow *
{stateName, type, bill, projectCost, electric
DataRow *
The DataRow object to be added to the Dat
DataTable *
solarTable
Excel Application Scope
"solarAnalysis.XLSX"
Do
Write Range
"SolarSheet"
"A1"
solarTable
Input Dialog
Dialog Title
"Solar Efficiency"
Input Label
"Whats the state you reside in?"
Input Type
Text Box
Value entered
stateName
Input Dialog
Dialog Title
"What for?"
Input Label
"Commercial or residential"
Input Type
Multiple Choice
Input options (separate with ;)
"Commercial;Residential"
Value entered


{} electricityPerDay
Get Text 'Financial Savings'
ooftop Area
130Sq.Feet
Financial Savings
Rs. 12.96/day
Save to
{} financialSavings
Build Data Table
DataTable...
Add Data Row
ArrayRow *
{} {stateName, type, bill, projectCost, electric


Monthly Bill
Type this
Standard
Secure
bill
Empty field before typing
Click before typing
Single line [End, Shift+H
Single
Verify that bill is typed
Type Into 'Your Category'
Your Category
Type this
Standard
Secure
type + "[k(Down)][k(Enter)]"
Empty field before typing
Click before typing
Single line [End, Shift+H
Single
Verify that type + "" is typed
Type Into 'Your State'

REFERENCES

1. Kuppusamy, Palanivel & Joseph K, Suresh. (2020). Robotic Process Automation to Smart Education. 3775.

2. Patil, Dr & Mane, Vinod & Patil, Dr. (2019). Social Innovation in Education System by using Robotic Process Automation (Rpa). International Journal of Innovative Technology and Exploring Engineering. 8. 3757-3760. 10.35940/ijitee.K2148.0981119.

3. Elkhatat, A.M., Elsaid, K. & Almeer, S. Evaluating the efficacy of AI content detection tools in differentiating between human and AI-generated text. *Int J Educ Integr* **19**, 17 (2023). https://doi.org/10.1007/s40979-023-00140-5

[4] H. Alamleh, A. A. S. AlQahtani and A. ElSaid, "Distinguishing Human-Written and ChatGPT-Generated Text Using Machine Learning," 2023 Systems and Information Engineering Design Symposium (SIEDS), Charlottesville, VA, USA, 2023, pp. 154-158, doi: 10.1109/SIEDS58326.2023.10137767.

[5] Tomáš Foltýnek, Norman Meuschke, and Bela Gipp. 2019. Academic Plagiarism Detection: A Systematic Literature Review. ACM Comput. Surv. 52, 6, Article 112 (November 2020), 42 pages. https://doi.org/10.1145/3345317

[6] H. A. Chowdhury, D. K. Bhattacharyya, "Plagiarism: Taxonomy, Tools and Detection Techniques", 19th National Convention on Knowledge, Library and Information Networking, 2018.