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PARKING MANAGEMENT SYSTEM AND ANALYZING SOURCE PLACE USING MECHINE LEARNING

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ABSTRACT

This paper explains a process that is underway, aiming to research and build an intelligent parking management system that improves how parking is used, minimises delays and improves how people use it. Parking spots can be monitored by the system as they become available and the sources of traffic, including the entrance and departure times of vehicles along with previous use, are also profiled. Data about vehicles' starting and ending destinations is used with machine learning to calculate where parking could be more sought-after. As a result of this prediction, spaces can be allocated more easily, making parking quicker and healthier for the environment.

Keywords: *Intelligent parking management, machine learning, real-time tracking, parking availability.*

1. INTRODUCTION

Rapid urbanization and the increasing demand for parking spaces has made it vital to develop smarter parking solutions that can handle scarcity of parking resources effectively. An Intelligent Parking Management System (IPMS) plans to solve this problem by exploring a smart method for parking space management and usage, therefore reducing traffic congestion and providing better user experience in parking facilities. Therefore, this paper makes an effort to present a smart system for parking management which is automatically connected to a wide range of parking spaces, taking information from the surroundings in order to optimize traffic flow and control parking space through machine learning, which not only allows to know in real, the parking availability, but also to be able to estimate when you will have a greater or lesser probability of finding available an empty parking.

By analyzing traffic flow and parking demand trends, the system uses data like vehicle entry and exit times, sensor readings and parking usage history. Predictions of future parking availability can be made utilizing machine learning models, and forecast of the popular places to park can also be made. It is this predictive quality that allows parking spaces to be best distributed, cutting down on time spent looking for places to park, environmental impact and ensuring a more fluid urban mobility.

The methodology employed in this system is to use algorithms which are Random Forest, (a meta estimator that fits a number of decision tree classifiers on various sub-samples of the dataset, performing a mean of them), Decision Tree (a decision support tool that uses a tree-like model of decisions and their possible consequences, including chance event outcomes, resource costs, and utility), [1], [2] and Support Vector Machine (SVM) (a supervised machine-learning linear model for classification and regression problems that finds the optimal separation through a hyperplane between the data points of different classes) [1], [2]. These algorithms cooperate and hence, enhance the efficiency and performance of the parking management system.

2. SYSTEM ANALYSIS

2.1 Existing System:

The current method of parking – a system of drop points featuring manual ticketing, cash and limited signage – is flawed, resulting in inconveniences including wasted time and fuel looking for parking and, most crucially, puts you the customer in a bad mood. Manual transaction can make it susceptible to crime for theft and vandalism while manually assigning it, needs regular maintenance cost also which leads to increase in cost.

2.1.1 Disadvantages:

- **Parking Guidance Restricted:** Manual ticket issuance and cash payments lead to inefficiencies.
- **Wastage of Space:** A lot of space in cities goes waste when it comes to parking.
- **Security:** Theft and vandalism from a manual system.
- **Maintenance Expenses:** Constant maintenance upkeeps cost and overhead.

2.2 Proposed System:

The system provides a dynamic parking guidance system and can direct drivers to available spaces, maximizing parking allocation. This minimizes the time spent searching for parking, congestion, and fuel wastage. It increases efficiency, and reduces carbon by forecasting parking availability. Moreover, theft and vandalism, or other crimes related with the parking can be identified and prevented, thereby can contribute to overall safety.

2.2.1 Advantages:

- **Real-time Parking Navigations:** Agents drivers on the real-time maneuver for available parking spaces.
- **Less Time Looking for Parking:** Search time is greatly reduced.
- **Less Traffic:** By knowing in advance, traffic and fuel can be saved.
- **Safer Environment:** Enables to detect and prevent the parking crimes.
- **Environmental advantages:** Helps to reduce exhaust emissions and improve air quality by reducing road congestion.

2.3 Module Description

The project is divided into three main sections:

1. **Home**
2. **Admin Login**
3. **Resident Login**

1. Home:

This module exposes the output of the web page.

2. Admin Login:

Admin module has a number of submodules:

- **Profile Update**: Admin user can update the personal information of Username, Password, Mobile No, Email, Address.
- **Populate Residents**: They are the following:
  - Add New Residents: Add the new resident details (Floor No, Door No, Name, Contact No, Email, Aadhar No).
  - Update Resident Information: Tracks and updates resident data.
  - Search Resident: It searches information of resident.
  - Back: Return out of the Add Residents section.
- **Add Vehicles**: This module manages vehicle details for residents:
  - Add New Vehicles: with this module you can register vehicle data of both residents
  - Add New Vehicles: Connects vehicles to residents collecting Vehicle No, Model and Resident Id.
  - Update Vehicle Info: to edit vehicle information.
  - Back: Exits the Add Vehicles module.
- **Add Parking Slot**: This module handles parking slots:
  - Add New Parking Slot: Adding new parking slots with Resident Id, Vehicle No, Slot, Amount and Type.
  - Action Update Parking Slot: Maintains update of parking slot, deletion and edit.

- Search Parking: Can be used to search for the details of a particular parking slo
- Back: Quits the Add Parking Slot module.

- **Complaints**: Raises the complaint of the residents along with ID, name, feedback and date.
- **Update Status**: Updates the resident status with the resident ID.
- **Charges**: Maintains card and parking charges.
- **Logout**: Terminates the current session.

3. Resident Login:

Residents should at the first time login with Resident ID provided by an admin. This module reflections admin's modules and accommodates the same operations.

2.4 Feasibility Study:

Model Testing:
The model can then be saved after training and getting the preferred results as follows:
model.save("`name_of_file.h5`").

Model Evaluation:
This stage is for measuring whether the model can be used in the world. A commercial offer is being prepared which includes the project design and price. The "feasibility study" is to make sure the system is sustainable in business terms. There are three important points to this analysis :

- **Economical Feasibility**
  This assesses the cost effect and whether the system can be implemented within a budget. The majority of used technologies are free, and a small number of customised devices need to be purchased.
- **Technical Feasibility**
  This also involves determining whether technical requirements of the system are feasible to be handled without oveloading the existing resource.
- **Social Feasibility**
  This indicates the acceptance of the system by the users. It means that the system is not intimidating to work with, and good training is available to support users.

3. System Requirements

3.1 Hardware Requirements:

Component	Specification
Operating System	Windows 7 or Above
Programming Language	Python
Frontend	HTML, CSS, JavaScript
Framework	Web-based Application (Flask)
Backend	SQL Server

TABLE1: HARDWARE-REQ

3.2 Software Requirements:

Component	Specification
Processor	Intel (Core i3) or Ryzen (Core 3)
RAM	4GB or Above
Storage	HDD: 500GB, SSD: 256GB

TABLE2: SOFTWARE-REQ

4. System Design

4.1 System Architecture:

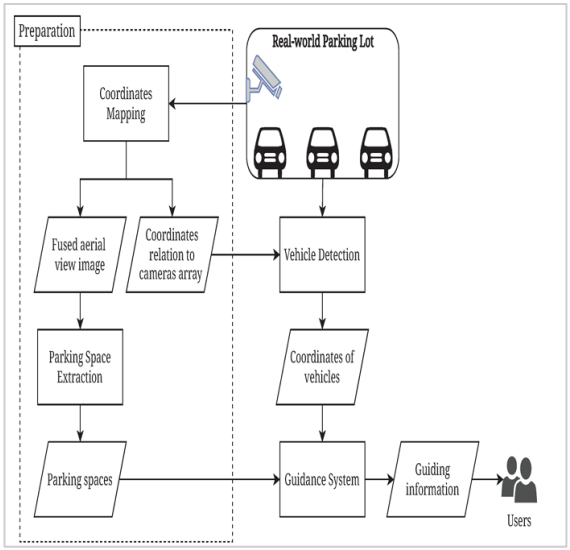

Fig1: Sys-Architecture

The structure of a Smart Parking Management System is shown in figure showing different components that work together to find available parking slots and guide users for efficient navigation to the destination. The technique starts by mapping of the parking plot location and stitching of multiple overhead building images to have a notional layout of the parking lot. It then looks for specific parking spots in the mapped area and links these coordinates to the live camera feed. The location

of vehicles is compared with the available parking spaces and are then provided as guidance to the users through a web browser application. This app provides parking availability and directions for better parking space utilization with computer vision, image processing, and real-time data analysis.

4.2 Data Flow Diagram:

The Data Flow Diagram, or bubble chart, is a simple graphic representation that depicts the input data to a system, the tasks that are performed on that data, and the output data generated [3], [4]. DFDs are used for modelling by illustrating processes, data storage, required data for processing and all components involved, as well as the data transfer between these various components.

DFDs map the path of data in the system and display how it changes from the beginning to the end. The graph includes the information flow and the various transformations used to process it. Level, even depth allows you to display the details of information and system operations as needed. As a result, a DFD can be made up of several levels, each adding more detail to the description of the system and how it transfers data.

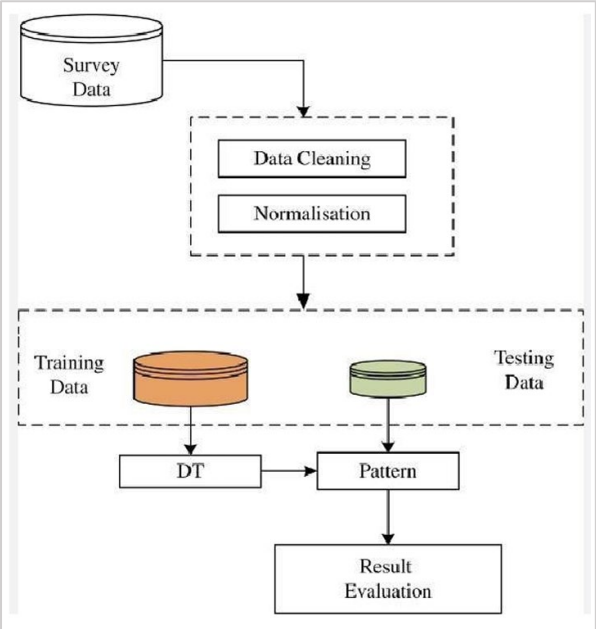

Fig2: Data Flow Diagram

5. IMPLEMENTATION

5.1 Machine Learning Technology

Machine learning deals with creating ways for systems to improve on their own, simply by being fed data. Within the scope of this thesis, learning is when the system can take in information, spot patterns in it and make choices using that information. Customised algorithms are used now because it is impossible to include all known inputs [4], [5]. To enhance decision-making, these techniques are built using concepts related to statistical science, probability theory, mathematical optimization, reinforcement learning, logic and control theory.

5.2 Stages of Machine Learning

There is a typical pipeline when being part of a machine learning project [3], [4]:

- ⇨ Defining the Problem
- ⇨ Preparing the Data
- ⇨ Evaluating Algorithms
- ⇨ Improving the Results
- ⇨ Presenting the Results

Machine learning is the study of automatic learning from observation/subsets of data by asking some heuristically or random-based queries. The idea is to develop algorithms that can learn from past data and then predict the future based on new inputs. In a machine learning system, training data (representing past experiences) is provided as input with the expectation that a some algorithm (as output) will be learned to perform the given task. The input data can be in a number of forms, for example, numeric, textual, audio, video, multimedia data.

5.3 Machine Learning vs. Traditional Programming

Programming can be very different from machine learning. Developers in the non-survey context are coding all rules manually with expertise from industry experts in classic programming. These rules are organized systematically, and the system performs operations according to predefined directives. As system complexity grows, more and more such rules need to be hand-coded, and this approach does not scale. On the other hand, is not slavery to rule-writing by machine learning. Instead, it makes the system to learn on its own, which leads to more generic and efficient solution to complex problems.

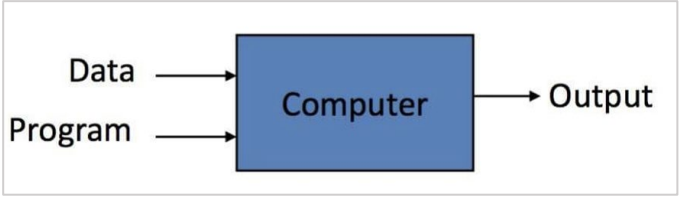

Fig3: Traditional Approach

Our approach is to use machine learning to solve this problem: we will learn by training the system which type of rule is to be applied to a given pattern of input and output data. There is no manual work for the

software developers, for each data update new rules must be programmed. The AI does not learn any better by inputting computer programs to it; instead, the AI increments, tweaks and optimizes their performance as it consumes more data and experiences, thus increasing accuracy over time.

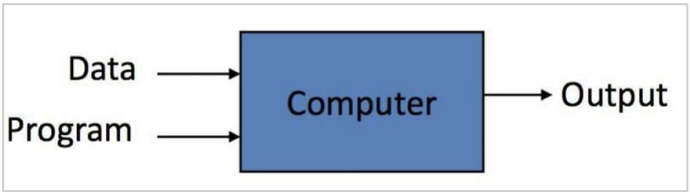

Fig4: ML Approach

6. TESTING

6.1 Test Cases

Test ID	Test Case Name	Input	Expected Output	Obtained Output	Result
T1	Profile Update	Username, password, Mobile No, Email Id, Address	Profile updated	Profile updated	Success
T2	Add Residents	Add new resident, Update resident details, Search residents, Back	Added new residents	Added new residents	Success
T3	Add Vehicles	Add new vehicle, Update vehicle details, Search vehicle	Added new vehicle	Added new vehicle	Success
T4	Add Parking Slot	Add new parking slot, Update parking slot, Search parking	Add new parking slot	Add new parking slot	Success
T5	Complaints	User given the complaints	Complaint received	Complaint received	Success

TABLE3: TEST-CASES

6.2 Test Results

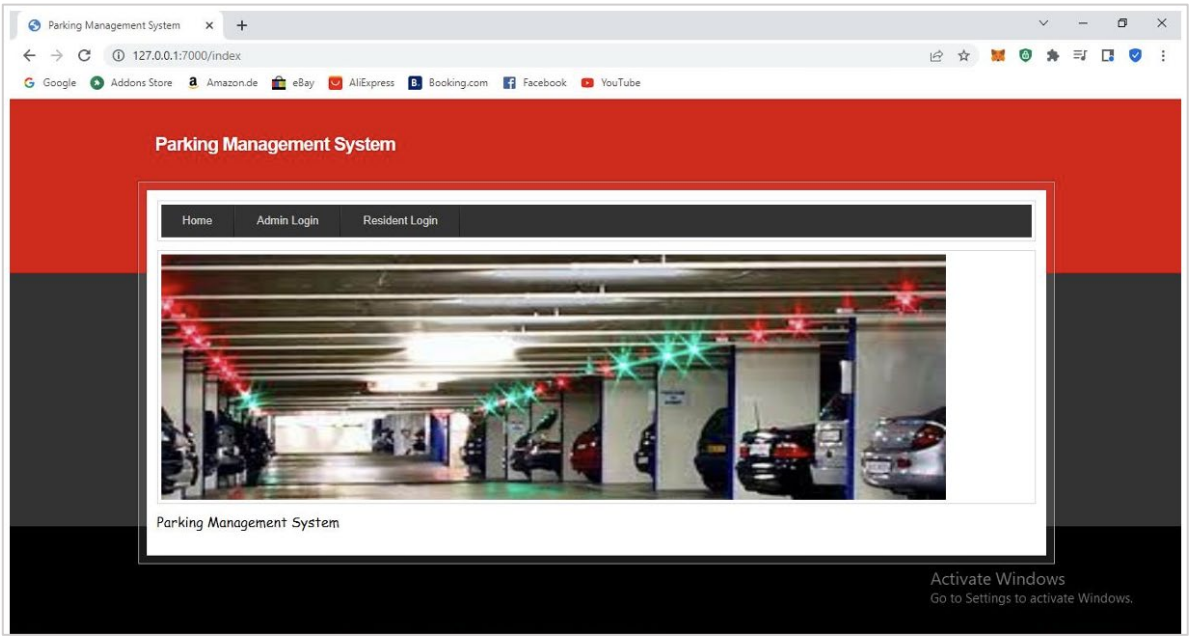

Fig5: Home page

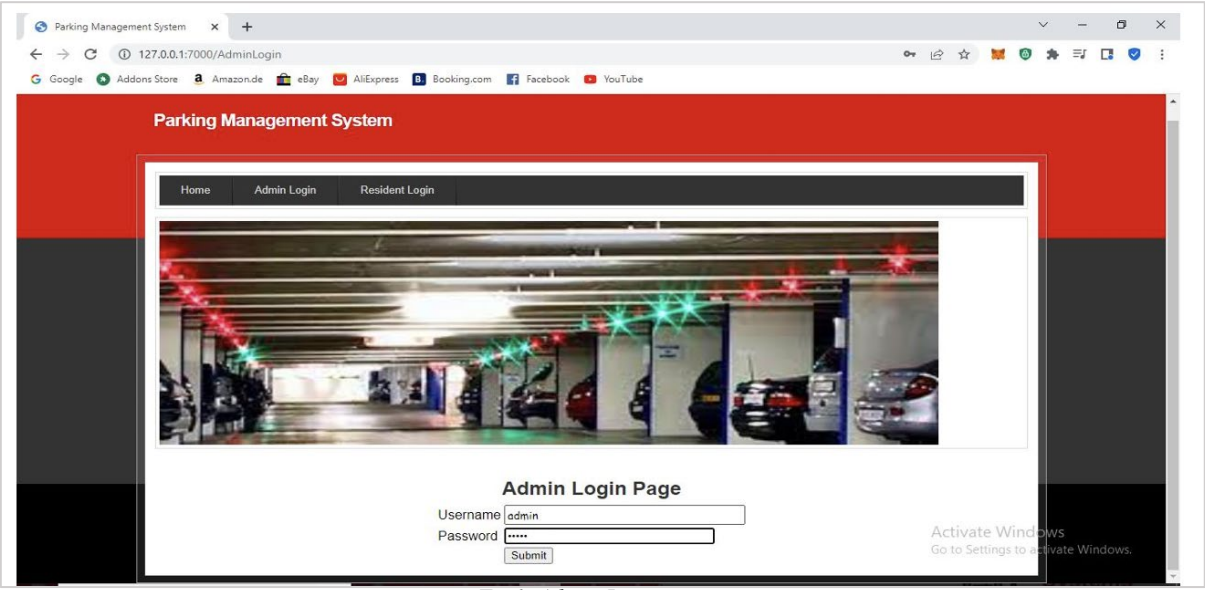

Fig6: Admin Login

7. Conclusion

The above indicates that the introduced machine learning-based parking management system may present a novel and efficient way of solving the parking problem, reducing traffic congestion and enhancing the parking experience. With Machine learning algorithms connected to real-time data and IOT sensors, the system provides accurate predictions, automates parking guidance and optimizes parking space allocation. This project has effectively demonstrated the transformative power of intelligent transport in urban mobility. By enabling use of state of the art technology, it helps to facilitate parking, and thereby plays a part in a more sustainable and userfriendly urban environment.

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Ibrahimpatnam Vennela

References

[1] W3Schools, "Python Tutorials, References and Examples," [Online]. Available: https://www.w3schools.com/python/. [Accessed: 18-May-2025].

[2] W3Schools, "Libraries Tutorials, References and Examples," [Online]. Available: https://www.w3schools.com/libraries/. [Accessed: 18-May-2025].

[3] S. S. Iyer, S. R. B. G. R. V. R. R. P. S. R. K. N. S. N. R. S. N. R. M. A. P., "Smart Parking System Using Machine Learning and IoT," *IEEE Transactions on Intelligent Transportation Systems*, vol. 21, no. 5, pp. 1331-1342, 2020.

[4] J. Liu, Z. Xu, Y. Y. Z. M. S. X. Y., "Parking Demand Prediction Using Machine Learning and GIS," *Transportation Research Part C: Emerging Technologies*, vol. 104, pp. 102-115, 2019.

[5] Y. Zhang, W. Z. T. F. Y., "Source Place Analysis for Parking Management Using Machine Learning,"

Journal of Intelligent Transportation Systems, vol. 24, no. 3, pp. 257-268, 2020.

