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| Project Name | **Inventory Forecasting and Analytics for Tata motors company – A case study for one Dealership** |
| Background Information | *Write here the background details of your proposed project work. This background information is the base of your proposal.*  Tata Motors, as a leading automotive manufacturer, operates within a complex supply chain network, involving numerous suppliers, dealerships, and service centres.  Effective inventory management is critical for Tata Motors to meet customer demands and to ensure the availability of spare parts and components while minimizing costs and optimizing operational efficiency across its distribution network.  *You may add the industry problem and the need for the study.*  The automotive aftermarket is characterized by diverse and unpredictable demand patterns influenced by factors such as vehicle usage, seasonality, and economic conditions. Traditional inventory management approaches, reliant on manual processes and basic forecasting methods, struggle to cope with the dynamic nature of aftermarket demand. As a result, Tata Motors, and other industry players grapple with issues such as stockouts, excess inventory, long lead times, and inefficient order fulfilment processes.  *By using the* power of data analytics and predictive modelling, which can address this need by leveraging advanced inventory forecasting and analytics techniques. The expectation from the proposed system is to Enhance Demand Forecasting, optimize inventory management, minimizing carrying costs, improve Customer Satisfaction. |
| Literature Review | *When you have thought about the idea, you must have checked about it in several publications to build a foundation for your work. Describe here in brief those studies that you have done.*  *At least 4 to 5 papers must be briefly introduced, Sources must be referenced using APA and IEEE.* |
| Statement of the Problem | *Be as specific as possible. This must be a more detailed version of the project name.*  To enhance inventory management efficiency within Tata Motors' dealership network, develop a robust demand prediction model utilizing historical data. The model aims to accurately forecast demand for spare parts and components over the next 2 to 3 months, facilitating proactive inventory planning and optimization. |
| Objectives | *Must be in points. (Maximum 4)*  Objective 1: Build an inventory analytics dimension model and to automate the data movement using an ETL tool  Objective 2: Develop a Historic Dashboard using Power BI for analysis of metrics and Dimensions  Objective 3: Develop models for forecasting and to select the best models.  Objective 4: Develop a dashboard to recommend actionable insights to business stakeholders based on current data. |
| Methodology | *Must mention the proposed process including data sources/data collection process/Implementation plan/Analysis and Insights.*   * The businessperson will place the xlsx/csv file in Mbox, which is then exported to Storage layer (cloud Azure). The files get picked up by ETL tool and ingests the data to the landing layer of Database. The Ingested data is pre-processed and transformed according to the planned dimension model using SQL. * Data is then fed to the Dashboard for Historic insights and the same data is pushed to ML storage layer for the ML models to pick and predict. * Further imputation is done on the dataset to handle outliers and scaling. * Once the contribution and correlational analysis have been carried out, the products that require forecasting are selected. * Multiple models are applied on the Dataset (ARIMA, ETS, Naïve Bayes, etc) and are evaluated for MAE and MAPE. The model giving best accuracy or minimum MAPE is further used for End-to-end automation. * The outcome/ predicted result is displayed in Dashboard as an actionable information. * The entire workflow will be logged for Audit purpose. |
| Proposed Solution/  Expected Results | Benefits of the Project for Stakeholders:   1. Users will have access to accurate and timely data insights, enabling informed decision-making regarding inventory management, procurement strategies, and resource allocation. 2. forecasting models will provide stakeholders with a deeper understanding of market trends and demand patterns, enhancing their ability to anticipate future needs 3. **Enhanced Operational Efficiency, this** will lead to reduced operational costs and improved resource utilization. 4. Automation of data movement using ETL tools and development of dashboards for analysis will streamline workflows, saving time and effort for stakeholders involved in inventory management tasks. 5. By ensuring the availability of spare parts and components, Tata Motors can reduce vehicle downtime and improve service turnaround times, leading to higher customer satisfaction and loyalty. 6. Optimizing inventory levels based on accurate demand forecasts will reduce stockouts, minimize excess inventory holding costs, and improve overall inventory turnover, resulting in cost savings and improved profitability.   Overall, this project will deliver significant business value by empowering stakeholders with actionable insights, improving operational efficiency, enhancing customer satisfaction, and optimizing inventory management practices. Additionally, the technical improvements, such as automation of data movement and development of user-friendly dashboards, will ensure ease of use and accessibility for stakeholders across Tata Motors' aftermarket division. |
| Detailed Scope of Work: | *Must have a flow diagram/high-level design. You may use MS-Visio or any such tools.*  [*Flowchart.pdf*](Flowchart.pdf) |
| Support needed from Program office | *JB Simha* |
| References | 1. Alexandra An Pavon Arnaiz, Lovely Samuele Cristal, Antonette Obligado Fernandez, Mark Rowie Flores Gubaton, Domingo Valenzuela Tanael and Criselle Jose Centeno, “Optimizing inventory management and demand forecasting system using time series algorithm”, World Journal of Advanced Research and Reviews, 2023, 20(03), 021–027 2. Blunsdon, B. “Inventory management in retail: A case study on Walmart.” ResearchGate, 2016 <https://www.researchgate.net/publication> 3. Aburto, L., and R. Weber. 2007. “Improved Supply Chain Management Based on Hybrid Demand Forecasts.” *Applied Soft Computing* 7 (1): 136–144. 4. Jonathan Hans Soeseno, Sergio González, Trista Chen “Streamlined Framework for Agile Forecasting Model Development Efficient Inventory Management.” ResearchGate 2023 https://www.researchgate.net/publication/370001220\_Streamlined\_Framework\_for\_Agile\_Forecasting\_Model \_Development\_towards\_Efficient\_Inventory\_Management |