

## AI based Resource Utilization estimation and prediction for public transportation using face recognition systems

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**Abstract.** These days face recognition systems are providing more avenues for research and application developers to rethink and design new methodologies to solve new problems in the society. Today, the public transportation system is facing number of issues namely infrastructure, roads, prediction of passengers availability and so on. The main challenge lies for investors in the prediction of passengers to allow transportation vehicles on roads. The proposed system is an AI based architecture designed to count the number of passengers (using face recognition system) on board at each moment of the journey from source to destination then create the dataset for prediction. The AI techniques are able to predict the density of the passengers during upcoming journey. The proposed work is implemented using python programming language for prediction process and web technologies for interface developments.

**Keywords:** Face recognition, Passengers density prediction, Naïve Bayes, Apriori Algorithm.

### 1 Introduction

Technology is one of the fastest growing field all over the world where in every instance one or another tech product enter the market to enhance the costumers experience day by day. Now a days digitalization is one of the most trending topics in the field of automation. Every sector is being attempted to be automated by tech enthusiasts leads to accuracy and no human intervention.

Public transport system place a major role in a country's transportation system which even generates the economical revenue. In India it is estimated that about 18 to 19% of country's density is carried out by public transports daily. According to UITP report of 2020b it is stated that the public transports are the minimal pollution emitting transport system by carrying large number of passengers than the personal vehicles [2].

To efficiently manage the passengers for their travelled count and prediction of transportation required among the various routes is a challenging task. The proposed solution has tried to provide an efficient solution using face recognition system and predictive algorithms. It helps in enhancing the passenger's experience, and also makes

better utilization of resources by predicting the approximate number of male and female passengers through gender recognition. This directly or indirectly helps in escaping of great economic losses to organizations and governments transportation industries.

## **2 Literature Review**

### **2.1 Artificial Intelligence and predictive models**

The implementation and accuracy of artificial intelligence are elevated by the day. It has revolutionized the industries by enhancing customers shopping experiences and optimizing businesses operations. AI implemented systems analyzes the patterns and nature of customers and recommends the products, leading to increased sales, easy availability and customer satisfaction. Additionally, AI-driven ChatBOTS provide instant customer support, resolving queries and guiding shoppers through their purchasing journey.

As mentioned by authors [14], the proposed solution is one of the major application of the AI in social world. Adaptive learning platforms also use AI to customize educational content based on each student's strengths and weaknesses, ensuring a personalized learning experience. It is integrated into various lifestyle applications, from personal assistants like Siri and Alexa to smart home devices.

AI can transmute healthcare sector by diagnosing , planning the essential treatments for the patients and also to plan the best optimizing the doctors time[15 AI algorithms can analyze medical images, predict disease outbreaks, and assist in drug discovery, enhancing the overall quality of healthcare services as mentioned by authors [16].

### **2.2 Face Recognition**

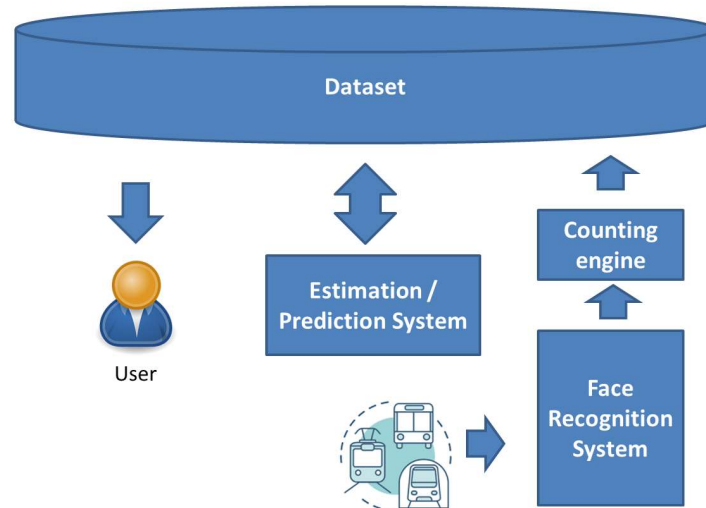
Facial Recognition system is also a one of the most essential technique where the emerging fields are most commonly using. Knowing fact that our face has about 80 facial points which can be differed based on marks, mouth, nose, detection of iris, distance between the eyes, sizes of the head and so on. Authors have proposed [10] has specified the real time face feature extraction using linear discriminant analysis(LDA) method and Authors have tried [11] to address the face misalignment problems. This face recognition technique has wide range of application in the field of emerging technologies such as finance, mobility, hospitality, telecommunication, social media, national security, transport, education and so on. These cutting edge solutions are supporting the research and environment in improving accuracy, efficiency, versatility, anti-spoofing measures, enhanced security and best user experience.

### **2.3 Public transport system**

All modes of transportation in India are under tremendous strain due to the country's urban population boom. The increasing demand for travel has entirely outpaced the available supply of transportation infrastructure and services. The majority of bus and

train services are cramped, unreliable, sluggish, and inconvenient. In addition, the writers [13] and [14] have described how cutting-edge technologies will be incorporated into transportation networks in the future. The majority of public transportation services are owned and run by the government, which has also significantly increased expenses and decreased productivity. Generally speaking, the proportion of urban journeys that are covered by public transportation rises with city size. As stated by the writers in [6] 30% of cities with a population of one to two million, 40% of cities with a population of two to five million, and 63% in cities with more than five million inhabitants. Therefore, the exceptionally quick development of big cities points to an increase in the need for public transportation.

### 3 Methodology



**Fig. 1.** Proposed methodology for the prediction of passengers based on face recognition system.

#### 3.1 Face Recognition System

Face recognition system has been involved in the proposed methodology to recognize the faces and bifurcate them based on gender [6]. These bifurcations are counted as male and female. Also, the face recognition is trying to avoid the known faces during the counting process.

The proposed system has counting engine that counts the number of male and female passengers boarded the bus at a stop and also record the number of passengers arrived at their destination. These source and destinations are identified through GPS values.

Finally in the database it contains the number of male and female passengers and their travel distances at a point of time. The vehicle owner can know the total passengers travelled report anywhere and anytime.

Figure 4 depicts the number of male, female and total passengers travelled in a month consisting of 31 days. The above can be utilized to analyses and predict the count of upcoming passengers in specific route.

### 3.2 Estimation and Prediction

Two models are discussed to perform the prediction of resource utilization.

**Apriori Algorithm.** It is one of the unsupervised machine learning algorithms which is used for the analysis of data based on the previously generated data. This algorithm helps to figures out the predictive analysis of the transaction made frequently which is stored in the relational data base. From this data base it identifies the items sets for estimation process. This algorithm performs its operations by calculating the support, confidence and the lift of the given components where in this system support refer to the number of passengers travelling Within the vehicle, lift is the contrast between the level of support and confidence, and confidence represents the proportion of the bus occupied out of all the seats available from source to destination and vice versa.

- The formula for Support is-

$$\text{Support (Z)} = \text{Trip containing item Z} / \text{Total number of trips} \quad (1)$$

Where, Z □ Number of routes

- The formula for calculating Confidence is-

$$P(Z|Y) = P(Y \text{ and } Z) / P(Y) \quad (2)$$

Where, Z □ Number of routes

Y □ Number of passenger travelled on particular trip

- The formula for calculating Lift is-

$$\text{Lift}(Y \square Z) = \text{Confidence}(Y \square Z) / \text{Support}(Z) \quad (3)$$

**Naïve Bayes Algorithm.** This algorithm helps in predictions based on the estimated data of density of passenger traveled on the particular public transport. A probabilistic classifier is what it is. The reason for this is that it makes the

assumption that each feature in the model exists independently of every other feature.

$$P(y|X) = \{P(X|y) P(y)\} / \{P(X)\} \tag{4}$$

where,  $y$  = number males or females travelled on the bus

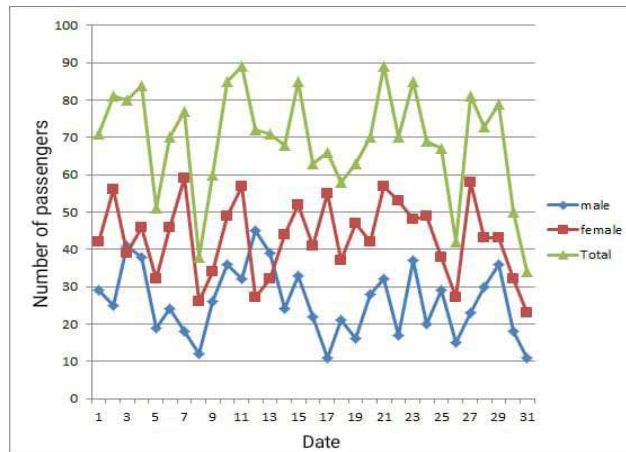
$X$  = Particular day in a week that required for prediction

#### 4 Results

**Table 1.** Sample details of the count corresponding to source and destinations.

Date	Source	Destination	Male	Female	Total
31.01.2024	Davangere	Chitradurga	33	52	85
31.01.2024	Chitradurga	Hiriyur	20	35	55
31.01.2024	Hiriyur	Shira	32	20	52
31.01.2024	Shira	Bangalore	17	32	49
31.01.2024	Bangalore	Shira	21	12	33

Table 1 depicts the source and destinations of the travelling based on GPS values. Also it has a count of male, female and total passengers. The female passengers count is much essential for the Government of Karnataka to make the payment towards KSRTC under Shakti Free Bus Scheme - 2023 [7].



**Fig. 2.** Day wise passengers count.

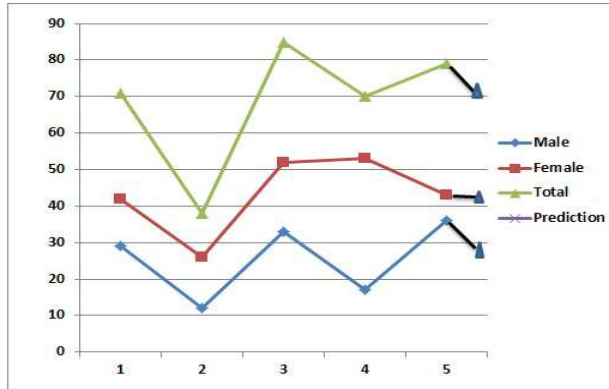


Fig. 3. Male, Female and Total Passengers count of Sunday with Monday count prediction.

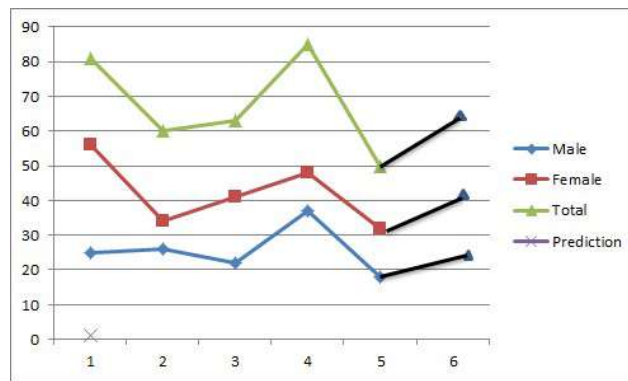


Fig. 4. Male, Female and Total Passengers count of Thursday with Friday predicted count.

Figure 3 and 4 depicts the male, female and total count of passengers travelled during the day also providing the predicted count of next days.

## 5 Conclusion

The use of Artificial Intelligence in public transport system has the potential to revolutionize transport system. This system keeps a count on number of passengers entered the vehicle and keep the record in its database which may also help in preventing ticket scams. Overall, the development of Artificial Intelligence based biometric monitoring system has the potential to greatly benefit the transport system by improving the efficiency and productivity of the buses and reducing the risk of losses. The paper is able to produce the count of passengers with male and female bifurcation. The bifurcation is useful to some of the government schemes related to public

transportation schemes. Also the proposed paper is able to predict next upcoming days of passengers count using AI algorithms namely Apriori and Naïve Bayes by using the earlier statistics.

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