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Artificial Intelligence for BEST Buses

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Abstract— The BEST is the sole provider of public transport of Mumbai, Maharashtra State.Although it has been into existence since many years, the problems that the passengers face are still numerous. Problems such as uncertain frequency of buses, uncertain delay of buses, problems caused due to rains, lack of knowledge to passengers, etc. The following system informs the passengers about the delay of the bus, position of bus, etc. The system is also featured to give knowledge about how long the bus will take to reach to particular bus stop, and the crowd density inside the bus. The Artificial Intelligence and Neural networks are the building blocks of the system that makes it robust and flexible. The primary intention of this project is to make the BEST system efficient enough to cater public demands and to correct unintentional delays caused by inefficient handling of bus schedule due to traffic. Based on all factors, the system suggests the future dynamic schedule for the buses.

Keywords — Artificial intelligence, BEST, dynamic schedule, neural network, transport

1 INTRODUCTION

The transport wing of Brihanmumbai Electric Supply & Transport Undertaking (BEST) is the sole provider of public transport in Mumbai. In recent years, BEST is trying to improve the transportation service by implementing CCTVs, Wi-Fi, digital ticketing and pass system, etc. But the existing system has lack of management, which in turn causes trouble to the passengers and to the State Transportation. The system is not sufficient to improve the overall performance of BEST. The static schedule of bus depots can neither predict the crowd nor can adjust according to demand of buses on a particular bus-stop. The lack of flexible time table and bus routes are the major issues currently faced by BEST and its passengers. The project implements such a system that rectifies the major problems and results in smooth transportation.

The system uses Artificial Intelligence for bus management by tracking the crowd on a particular bus-stop and real time updating to the central unit or depot. The main objective of the system is to enroute the BEST buse on the less time consuming track, set the supply based on demand of the bus and to provide tracking and certainty of the buses. This saves time and is convenient to the passengers. The system constitutes of low-power, inexpensive devices that accommodate processors, image processing unit, wireless communication interface and power sources, in a robust and tiny package.

2 HARDWARE

2.1 Arduino

This unit is a part of the hardware at the bus stop. Arduino Mega2560 is the processing unit used in the system. It is small in size and operates on 5V supply. Its operating frequency is 16 MHz with 256 kB flash memory. The arduino unit is connected to the camera unit and the router. It processes the input obtained from the camera for cluster counting. It also communicates with the processing unit (slave) in the bus that arrives at that particular bus stop.

Fig. 1 Arduino board

2.2 Camera

The arduino camera module with shield is used for cluster counting. It is a low-cost image sensor, DSP-night vision-that can operate at a maximum of 30 fps and 640 x 480 ("VGA") resolutions, equivalent to 0.3 Megapixels. The captured image can be pre-processed by the DSP before sending it to the processing unit. It captures the images of the passengers standing at the bus stop.

Fig. 2 Camera module

2.3 Router

The routers are placed at every bus stop. They are used for wireless communication between the bus and the bus stop.

The router specifications are limited by the operating range of router and position of bus arrival. The router sends a notification of bus information to the processing unit (arduino), as soon as the bus arrives at the bus stop.

2.4 GPS tracker

This is a GPS based vehicle tracking system.All the buses are equipped with GPS tracker. The GPS tracker helps to provide co-ordinates of the bus position, which helps to locate real time bus position. The bus position facilitates tracking of the bus and gives the estimated time to reach the particular bus stop.

3 SOFTWARE

3. 1 Cluster counter

At times, it is important to estimate in real-time the number of people in a crowded environment. In case of the bus stop, it is necessary to get approximate number of passengers waiting for the bus. Currently there are no proven techniques for estimating the size of a large crowd.

Counting crowds is a difficult problem because there are many conclusions. Even with strong prior assumptions and no computational limitations, often it is impossible to count the crowd from a single view. One of the possible solutions to this problem is to use many sensors in a sensor network. The sensor network can form clusters according to the geometry so that each cluster can count the number of persons at a local checkpoint.

3.2 Artificial intelligence

Artificial Intelligence (A.I.) is intelligence exhibited by machines. It is the computability of the system that enables it to think, to test the possible outputs based on the inputs applied, and to give the best of them as the result. The Artificial Intelligence is the brain of the system, which calculates demand of passengers for each bus. It resides at server side at the bus depot.

A common component of deep learning, the neural network, is made up of layers of computational units called nodes that are linked together with weighted connectors. Data is fed at the input layer, and then moved to hidden layers that perform computations and pass them along to an output layer. The data fed to the neural network gives estimate of demand of the passengers for each bus at that respective bus stop. If the system incorrectly classifies the demand, the neural network must be tweaked. To do this, signals are automatically sent back through the network, telling those incorrectly weighted connections to adjust their weighting values. It happens many times with many different examples until the network learns to identify a particular object with an acceptable level of accuracy.

3.2 Neural network

Neural networks -- also called artificial neural networks. In information technology, a neural network is a system of hardware and/or software patterned after the operation of neurons in the human brain. There is a variety of deep learning technologies. Each neural unit is connected with many other units, which form a complex network of large number of neural units. Each individual neural unit may have a summation function which combines the values of all its inputs together.

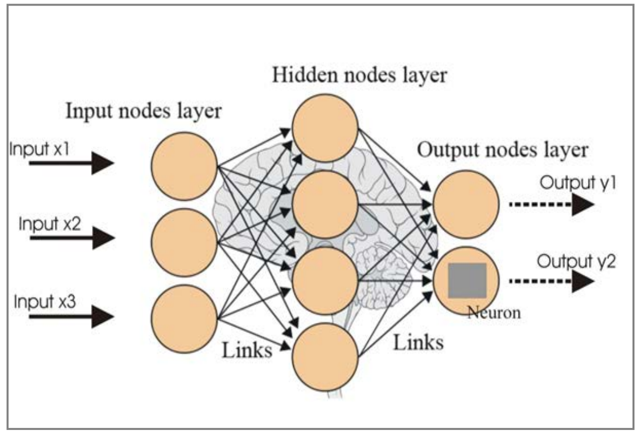

Fig. 3 Neural network

The neural network is used to consider all the possible cases that might take place with the bus and the passengers. It gets the input from database, in the form of a table that shows bus number, its time of arrival and number of passengers stepped inside the bus from that particular bus stop. According to this data, the neural network generates the possibilities of the crowd demand for each bus at that respective bus stop. This data is analyzed by the AI to generate the plot of crowd demand with respect to time for a particular bus at the particular bus stop. This plot is later sent to the server at the bus depot, which makes changes in the schedule accordingly.

3.4 Database

The database acts as storage unit of raw data, to be processed by the neural network. MySQL is used for the database. The database gets the data from the bus stop. The data consists of bus number, time of arrival, number of passengers stepped inside the bus. It is processed to obtain the plot of demand for each bus at respective bus stops.

4 IMPLEMENTATION

The system is split into three main subsystems, namely bus stop, bus (inside) and the bus depot. The bus stop subsystem and bus (inside) subsystem are the clients, and the bus depot sub-system is the server unit.

The bus stop subsystem consists of arduino processing unit, camera module and router interface. The camera is used for cluster capturing and image processing is done in arduino, to get the estimate of cluster count. The router is used for wireless communication with the bus subsystem and the de-

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pot server.
The bus (inside) subsystem consists of GPS module and Wi-Fi transceiver. This transceiver links with the router as soon as bus arrives at the bus stop. The GPS provides the real time tracking of the bus.

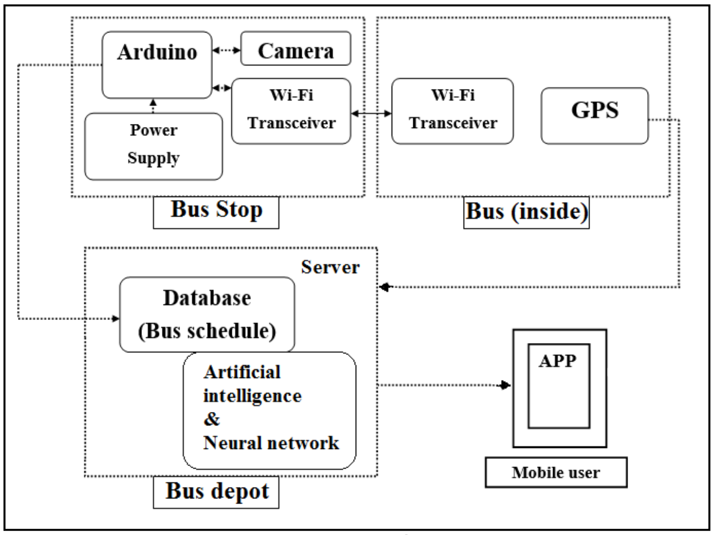

Fig 4 Working of the system

The bus depot subsystem consists of artificial intelligence and the database. This subsystem acts as server of the entire system. The processed data contains the bus position, estimated crowd at the bus stop and time taken by bus to arrive at the bus stop. This data is transmitted and then updated in the mobile app, which is at user side. Thus, the user gets real time status of BEST bus.

5 CONCLUSION

The proposed system can be implemented to overcome flaws of service provided by BEST. The system is durable and useful for any location. This system makes transportation service provided by BEST, more flexible and user- friendly. The system is a one-time investment. Once the system is implemented, the best of the BEST service can be provided to passengers. The system can be implemented all over the state and ultimately all over the country for a flexible and time saving service, not only to the passengers but also to the service provider. This will help the BEST to raise their profits and maintain forgein in standards.

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