

London Buses' iBus system

Over the last decade, bus patronage in London has increased by 57 per cent. Every weekday 8,500 buses run on almost 700 routes, carrying 6.4 million passengers and well over 2 billion trips are made on London's buses annually. The transformation of the London bus network in recent years is a great public transport success story!

As the bus network has grown, so have the demands placed upon it. Passenger expectations have risen – today's London bus passenger demands reliable, accessible services and effective journey information. The previous London Buses radio communications and vehicle location system, designed for a much smaller bus fleet, could not cope with the continued development and expansion of the network – a new system was needed that provided more effective monitoring of bus services and better radio communication.



iBus, one of the world's largest integrated vehicle location and passenger information systems, was introduced in response to these challenges. Delivering better radio communications for drivers, real time journey information for passengers and accurate bus service monitoring for controllers, iBus is revolutionising how bus services are delivered in London.

Passenger Information

From a passenger's viewpoint, a key benefit of iBus is real time journey information. On board audio announcements and visual displays inform passengers of the route number of the bus, its final destination and the name of the next stop. Recently some selected places of interest have been added as an 'alight here for' announcement on the bus. Passengers, particularly tourists and people travelling in an unfamiliar part of town, can find their way around more easily. On a network of the size and complexity of London's, providing passengers with clear, concise information is of vital importance.

Some of the people to benefit most from iBus are those with visual or hearing impairments, or other disabilities such as learning disabilities. London Buses already boasts the most accessible fleet in the UK for disabled passengers. The entire fleet comprises of low floor, wheelchair accessible vehicles, with the exception of a small number of Routemaster buses running on two heritage routes. It has been welcomed by the Guide Dogs for the Blind Association, which has reported an increase in the uptake of mobility training on London's buses among its members since the introduction of iBus.



In addition to automated announcements, iBus enhances the driver's ability to communicate with passengers, providing them with a tannoy system as well as a range of pre-recorded announcements for use in situations they regularly encounter. For example, when the bus is crowded, drivers can use a pre-recorded announcement to ask passengers to move down inside the bus.

Automatic vehicle location and direct driver-passenger communication work together to enhance the information provided to passengers.

It's not only on board that iBus is improving the quality of information provided to passengers. The bus arrival times displayed on Countdown signs, installed at around 2,000 of London's 19,000 bus stops, are now more accurate. Before the introduction of iBus, these estimates were calculated using roadside beacons which registered the position of the bus as it passed them and compared it to the three previous buses. iBus is considerably more sensitive and flexible, constantly updating bus location information using GPS and a sophisticated location algorithm to predict an arrival time.

Enhanced Radio

Despite its considerable benefits for passengers, improved passenger information was not the primary reason for the development of iBus. The system began life as a response to the need for better radio communications and service control tools across the bus network. In the early 1980s, London bus fleet was half its current size and relied on a Band III radio system for communication between drivers and service controllers. Following significant growth in the bus network, the old system had come to the end of its useful life and needed to be replaced. This coincided with the withdrawal of Band III licences by OFCOM in response to an international agreement to free up spectrum for digital broadcasting. In response to this London Buses migrated their radio system to the newly allocated frequencies in the mid-Band spectrum



The iBus radio system is designed to cater for the growing needs of London's bus network with scope for expansion beyond the current fleet size. As well as increased resilience, wider coverage and better quality radio communications, the iBus radio system offers service controllers the ability to choose to speak to their entire garage fleet, individual drivers, or specific groups of drivers in one area or on one route.

iBus' combination of improved radio and automatic vehicle location comes into its own when a driver needs to report an incident on the network. CentreComm, London Buses' emergency and control centre, handles up to 1,300 calls from London's 23,000 bus drivers every day, covering everything from cars parked in bus lanes to major traffic

incidents. Previously 40 per cent of the duration of the average call was consumed by identifying the location of the bus. Now this information is immediately displayed for the CentreComm staff on an on-screen London street map. Calls can be dealt with more efficiently and, where necessary, emergency services and/or London Buses staff can be alerted to an incident faster.

CentreComm can also talk to individual drivers or broadcast a message to groups of drivers. iBus also allows CentreComm staff to send messages to passengers via the on-board signs and broadcast over the PA system to bus passengers in the event of a major service issue or other emergency.

Service control and performance

Through the data it provides to Service Controllers, iBus is helping to deliver a more reliable bus service.

Bus services in London are contracted to private operating companies. Rather than merely paying operators by the number of bus kilometres covered, contracts are designed to incentivise them to run a reliable service, with a two year extension to the five year contract automatically available if specific performance targets are met. In order for this system to work effectively, London Buses needs accurate data on the performance of individual operators and routes. iBus is a valuable addition to the tools London Buses has at its disposal to monitor performance, providing detailed running time reports that compare the actual running of buses against the schedule. This information provides an accurate picture of reliability, and a good indication of the performance of specific routes and operators.

The operators themselves are also benefitting from the sophisticated journey information provided by iBus. The system has been installed in service control centres at bus garages, providing controllers with a live representation of where buses on a particular route are at any one time, and whether they are ahead, behind or on time. The improved radio communications offered by iBus mean that messages can be quickly and accurately relayed to bus drivers to ensure they take corrective action.

Logistics and challenges

iBus has to be much more than a Global Positioning System (GPS) for buses. Traditional GPS has limitations, especially in large cities such as London, where satellite signals can be affected by surrounding buildings – known as multipath and urban canyon effects. What makes iBus location positioning unique is the enhanced navigation algorithm it uses to generate information on the location of each vehicle.

The navigation algorithm uses four sources of information in addition to conventional GPS to identify the location of a bus. Firstly, an on-board odometer provides a measure of the distance the bus has travelled from the last stop.

Secondly, known points the bus has passed are matched to the route – each bus stop is a known point, and when a bus opens and closes its doors this is recorded. Thirdly, on-board gyroscopes record corners turned by the vehicle. Finally, iBus checks the bus' position against the route it should be following. The inputs from each of these measurements are combined and from this the iBus software calculates the bus' position on the road.

Once the iBus system had been developed and tested, the next logistical challenge was installing it on London's 8,500 buses. Buses were fitted at a peak rate of 28 per day at one of two installation centres in London or by a roving team which fitted buses in situ at garages. The aim during the installation was that no bus should be out of service for more than a day, some considerable challenge given the vast range of bus makes and models that make up the London fleet, each of which demanded a slightly modified installation process. Meticulous planning saw that the installation centres were aware well in advance of exactly what bus specifications to expect on any given day, and this information was combined with some hi-tech warehousing to ensure that 97 per cent of buses were fitted out successfully and back in service the next day.

Developing the 'data' for the iBus system presented a further logistical challenge. The system was required to provide precise information across 700 routes and 19,000 bus stops, each of which was subject to a full audit to ensure that the actual stop on the ground and the stop name and location on the iBus system matched. Once the data had been checked and validated, a voice artist,

Emma Hignett, was recruited to record each of the route numbers and stop locations for audio announcements. Emma began recording bus stop names at the end of May 2006 and completed them in summer 2007.

The success of iBus was continually monitored and assessed as the roll out progressed and adjustments and changes to the system were made based on this feedback. The volume of announcements was one issue that required careful attention to ensure they could be heard over background noise, whilst not being uncomfortably loud in quieter conditions. Following careful analysis of the different types of bus and levels of background noise encountered, levels have now been set that are acceptable for the vast majority of passengers. However the constant renewal of the London bus fleet and the introduction of new bus types, such as hybrids with quieter engines, will mean that work to refine the system is ongoing.

The future

The roll out of iBus was completed in April 2009 and will serve as the back-bone of London's bus network for the foreseeable future. London Buses is already assessing how to use the information generated by iBus, with plans for the future including the provision of predicted bus arrival times via the internet, mobile phones and a new generation of Countdown signs for its passengers.

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