Dependable
Real-time onboard: an end to fake news on bus and tram displays

Simple
MENTZ E-ticketing takes the cumbersome decision making out of the ticket purchasing process

Economic
Plan and save with integrated optimisation
A PASSENGER IS NOT AN EDITOR

In this day and age, opening an internet browser, pulling out a smart phone or even buying a newspaper gives you access to an endless amount of information. At the same time, many of us feel less informed in the various aspects of life. At least viewed subjectively, the current information environment has led to worse outcomes. This can be seen through the use of terms like “fake news”, “alternative facts”, “Lügenpresse” (lying press) etc.

Usually the problem is not because of too little information, but rather an excess, combined with stark variations in quality. Social media, in particular, lack basic standards for trustworthiness and presentation. Readers are thus forced to become editors; they have to filter and evaluate information. This is a role which most people either cannot or are not willing to perform. The result is a loss of trust that has had a noticeable impact on society.

In public transport, we would like to avoid this situation. Passengers don’t have to be editors. The flood of information – from real-time vehicle positions, to incident messages, to fare rules – needs to be easily accessible, should be simple to understand, and must be presented consistently across all media channels. This is the best way to build trust in public transport. Such trust is the basis for increased patronage.

In the current issue of Mentz Magazine, we present a number of projects in which this guiding principle has been successfully put into practice. The goal is to copy and imitate these ideas. On page 4 you can find out how passengers in Basel will be informed in real-time about delays and connections in the near future. On pages 14 – 16 you can read how ticket purchasing can be made intuitive using only a few clicks, despite having 60,000 different tickets on offer. We even have something in our program for our transport schedulers, the initial hard evidence regarding the use of integrated optimisation can be found on pages 10 – 13.

If one of these topics has sparked your interest, you are welcome to see it live at the InnoTrans exhibition in Berlin from 18 – 21 September 2018. My colleagues and I will be happy to welcome you at our stand.

I wish you happy reading.

Christoph Mentz
Managing Director
MENTZ GmbH
Customer project
When changing vehicles, every minute counts. MENTZ brings real-time information on board BVB buses and trams. Fake news on displays and wasted sprints to vehicles that don’t leave on time are becoming a thing of the past.

Switzerland, Basel

Product
IRMA (Interchange Refinement and Management of APIs)

Function
Background system for real-time in vehicles

Contact
nguyen@mentz.net
MENTZ is bringing a pioneering service to buses and trams: passengers can already see via onboard displays what will happen at the next stops on the journey. How do I get to the connecting route? How many minutes do I have to wait until my connection arrives? Dynamic displays in the vehicles provide dependable connectional information in real-time.

Displays for passenger information have been standard equipment in public transport vehicles for a long time. In many places, very limited information is displayed alongside the advertisements, and the news is not really up-to-date. As a result, it may not be possible to make the indicated connection due to a delay, and an unplanned alternative connection does not get displayed at all. Or the indicated interchange times are not accurate, which is why the sprint to the next platform turns out to be a wasted effort. In Basel, the age of this kind of fake news has come to an end. In the buses and trams of the Basel Transport Authority (BVB) new intelligent displays are going into operation. Now, for each stop, the monitors always display the latest information for all connections and for all means of transport. The technology for this has been developed by MENTZ.

IRMA – Data Exchange in Real-Time
The centrepiece of the flagship project “Real-time in Vehicles” is the IRMA system (Interchange Refinement and Management of APIs), which has been newly developed for the project by MENTZ. In IRMA, data are collected from and provided to various sources. Communication between IRMA, the data sources and data consumers is based on the VDV standard 431 TRIAS, an interface that is specially tailored for the exchange of data between real-time sources, vehicles and mobile apps. This makes it possible to request information from timetables, such as from the Transport Authority of Baden-Württemberg (NVBW), whose electronic journey planner (EFA) is linked to the BVB – and includes real-time information and explanatory note text. The idea behind IRMA: Integrated data from the NVBW-EFA system are intelligently cached and can thus be supplied to different customers without the request load on the journey planner spiralling out of control (see infographic p.6).

Filtering for Relevant Information
The highlight: IRMA filters the responses according to customisable rules. Authorised users of the customer’s system can adjust the filter rules for IRMA in a matter of seconds. In this way, specific trips or entire routes can be filtered out at individual stops. Unattractive interchange options,
Many identical requests place stress on the system.

Identical requests are responded to by IRMA from the cache, thus reducing the load on the system.

IRMA (Interchange Refinement and Management of APIs)

Timetable information, e.g. EFA
Intelligent filters, sort by relevance

- By stop positive/negative filters for routes can be specified
- IRMA supports route filters in the request
- Filtering of relevant incident messages
- When generating connection boards (e.g. for vehicles) IRMA also accounts for transferred information for the requesting trip – and hides correspondingly unattractive connections from view

Caching reduces the request load

- The “first” request is passed on to EFA
- If a request for the same stop is made within a customisable time period, it is responded to using the cache instead of sending a new request to EFA

Supported formats: VDV 431 TRIAS

such as travelling in the opposite direction, to make the connection can be hidden. In combination with individual filtering for the requested vehicle, buses and trams are able to show dynamic connections on board.

Consistent Information in the App and on the Display

Subcontractor LTG Switzerland GmbH (formerly Gorba AG), who equip the BVB vehicle fleet with on-board displays and supplies them with passenger information, has added a GPS-based positioning function to the existing TFT display software. It enables calculation of the trip time of the vehicle. Additionally, the display system collects real-time data for connection and disruption information directly from IRMA and independently of the onboard computer – an innovation that provides operators with more flexibility and less dependency on third party systems. Using this interface, not only displays in buses and trams can be supplied with information, but smart phone and/or web applications can profit from this, too. This ensures that information is consistent across all media. MENTZ has been partnering with the BVB for many years. The family-owned business in Munich has developed the DIVA system for Basel, and supplies the EFA trip planner for the NVBW. The “Real-time in Vehicles” project will be fully implemented by the end of 2018. Release to the entire BVB fleet will be completed by the summer of 2019.
We show all relevant departures

Reto Koller is the project head for operational systems at the Transport Authority of Basel (BVB), and is responsible for implementing the project “Real-time in Vehicles”, for which MENTZ is developing the back-office system. We spoke to him about the project and the topic of digitalisation.

MENTZ: Mr. Koller, so-called static interchange information notes are already displayed in BVB vehicles. For example, in a vehicle of route 34, I might see that I can transfer to route 61 at stop “Kronenplatz”. What added value do you expect from your project “Real-time in Vehicles (RiV)”?

Koller: Currently, when looking at the display in a vehicle, I can only see which basic interchange options exist. These displays are only really showing static information, meaning that they represent only a pictogram for each stop. I can’t tell if my next connection will actually depart. This additional information is especially useful during off-peak hours. If we stay with the current example: at night, route 61 only departs every half hour. If I’m on route 34 and see that the next departure is in 25 minutes, I might decide to take route 34 a few more stops and then walk ten minutes. I would get to my final destination quicker than if I had waited at “Kronenplatz”. But if the 61 departs in five minutes, I’ll take the connecting vehicle and ride to a stop that is closer to my final destination. This situation is common for commuters that want to arrive at their destination a few minutes earlier by making decisions about where and if they should interchange between vehicles. Even tourists, who generally have more time, but don’t know the ins and outs of the local timetable, can benefit from more precise information.

MENTZ: How do you assess passenger acceptance for a system that bases its display of interchanges on real-time data — and as a consequence, can result in new dynamic trip connections, but also in familiar connections being ignored?

Koller: Clearly, the space available on the in-vehicle display is limited. We only show the next six routes, and depending on delays, the information displayed is subject to change. Yet this is exactly what passengers are accustomed to from the PIS-displays at stops: we only show the next relevant departures. By the way, we also thought about a backup-mechanism, in the event where real-time updates are not possible due to gaps in network coverage. In this situation, we show the transfers according to the planned timetable which was previously uploaded to the vehicle. Even this limited information is more accurate than the pictogram.

MENTZ: The RiV-background system, which is being developed by MENTZ, sends requests to the same electronic trip planner (EFA) that is used by the

Always up-to-date
In the buses and trams of the BVB, intelligent displays provide the latest information for each stop — for all connections and for all modes of transport.

Interview:
with BVB Managing Director
Reto Koller
**BVB trip planner and apps. Why did you select this architecture?**

Koller: Basically, we had to choose from two different architecture variations. We could have sent requests to our own control centre system. The problem is that the system doesn’t contain the trips of other operators. Or we could use the EFA trip planner. Using EFA we have the departures of SBB-trains and the bus routes of other operators that intersect with our routes. EFA is constantly supplied with the latest real-time information by the central data hub and ensures that the information displayed is indeed up-to-the-minute. Moreover, we achieve consistency of information across various channels because passengers see the same information as is in the app.

**MENTZ:** Speaking of apps – smart phones are now the norm. They allow passengers to retrieve information en-route about when a vehicle departs from the next interchange point. Do you think that this will make the departure displays in vehicles unnecessary?

Koller: I’m not so sure. When I’m on a bus, I like to look out of the window, read a newspaper or check my emails. Returning to the example above, I don’t want to have to look up the departures of route 61 on my smart phone before arriving at “Kronenplatz”. I’d rather just check the display in the vehicle. We also show service disruptions on the displays because we can’t expect passengers to constantly check whether a route has been delayed. We see another benefit where smart phone and real-time information can complement each other in a vehicle. Just as an idea: an app could be developed for the visually impaired. Using Bluetooth, an unique vehicle identification could be assigned by the app. This could help the passenger recognise the correct vehicle when boarding. During the trip, the same real-time information in the app can be conveniently displayed on the display in the vehicle and announced audibly.

**MENTZ:** When vehicles exchange data with background systems, it can be viewed as a step towards digitalisation. Where is the BVB in its digitalisation process?

Koller: First – what is meant by digitalisation? At present, digitalisation is a buzzword. But considering its more precise meaning, it’s clear that we began this process a long time ago. For example, we have a computer-based control centre, and computerised timetable planning, duty scheduling and trip planning. The RIV Project can certainly be included on this list, but there are many other topics. For example, with implementation of the Swiss Federal Act for Equal Opportunity, we want to use smart phones to provide support for people with disabilities. We are also working on a digital solution to capture vehicle positions in depots, which serves as the basis for the electronic dispatch of vehicles. Also, analogue signals between the control centre and vehicles are to be replaced by digital communications. Another current project in which I am involved, is one where incidents are still recorded first on paper and are subsequently entered into a computerised system. In the near future, a computer in the vehicle will be in direct contact with the control centre server so that the details of the incident can be transferred immediately.

**MENTZ:** Mr. Koller, thank you for your time.

Interview conducted by Matthias Erven.
Efficient

Timetable planning, vehicle and duty scheduling, personnel assignment and vehicle dispatching in public transport must satisfy many requirements. Using MENTZ’s integrated optimisation, even the costs can be kept under control.

Software and service

Product: Software to design duty and vehicle schedules
Function: Integrated optimisation
Contact: info@mentz.net
The integrated duty and block optimisation module by MENTZ allows planners to become designers. The reason for this is that the new software solution provides automatically optimised duty and vehicle block schedules. It is also an effective tool to control and manage costs. Using the integrated optimisation module helps transport companies optimally prepare for future challenges – whether they take over the controls themselves or order optimisation as a service from MENTZ.

In the Field

Fully Unlock Your Savings Potential

Practical optimisation software not only has to work in a controlled environment, but also has to produce the desired result in the real-world conditions of collective bargaining agreements. To address this situation, MENTZ created practical data for different scenarios with the help of our customers during the first phase of development. The integrated optimisation module was then tested in real-world situations using existing collective bargaining agreements. The results of the simulation were compared to other optimisation methods – and they stacked up well:

Results achieved using optimisation*

- Reduction of working time by 5 hours compared to a very good existing duty schedule with 66 duties. The result is only 3 percent different from the original.
- 50 percent fewer split duties (with fixed costs). This enables the solution to be implemented with the workforce more easily whilst maintaining the same cost neutrality.
- Reduction of three duties (from 77 to 74 duties), without increasing the number of split duties.
- Reduction of paid driving time by 8 percent (for the same number of duties).
- Reduction of maximum working time from 13 hours to 10 hours with a 21.5 percent increase in fixed costs.
- Reduction of two duties with increased allowance for shift types.
- Savings of one vehicle and two duties through the higher weighting of empty trip kilometres with identical timetable sizes.

* The results were calculated for realistic use cases. The precise impact in practice depends on the underlying networks and existing costs.
In addition to legal frameworks, collective bargaining agreements also play a decisive role in the planning of duty and vehicle schedules. The integrated optimisation module also accounts for individual requirements, like a special duty where a driver has to balance work and childcare.

In the optimisation module, all agreements within a transport organisation can be represented without having to adapt individual modules – even when demands change suddenly.

In addition to the vehicle and driver costs, the software also accounts for customisable KPIs (key performance indicators), which are created using a simple module. Requirements for sub-items can be combined freely by users and tested, ranked or allocated by cost according to specific properties. Sub-items can be breaks, duty splits, vehicle changes, route combinations, shift types and driver trip times.

Overview of Planning and Costs

The dashboard of MENTZ’s optimisation module displays duties, vehicle blocks and depot utilisation on the same timeline. The most important relationships between empty trips, vehicle capacities, blocks and duties can be seen at a glance. The overview clearly shows the implications of changes to the cost specifications.

Planning example with specific requirements:
Partial duty times (PD): Maximum of 10 percent to partial duties with a duration between 5.5 to 5.75 h Presence times (PT): Maximum of 20 percent with an extended presence time over 10.5 h to the legal limit Working hours (WH): Maximum 30 percent with extended working hours over 8.5 h up to the legal limit
Split duties (SD): Maximum of 10 split duties Shift times (ST): Maximum of 2 duties in the early shift

Performance indicators that show a need for optimisation

PD > 5.75 h 0 20 0 0
PD 5.5 - 5.75 h max. 20 % PT > 10.5 h max. 30 %
PD 5.5 h WH > 8.5 h
Early shift max. 10 SD

Values are in target range

FITS ALL TYPES OF OPERATIONS

Customisable to cover all bases

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The dashboard of MENTZ’s optimisation module displays duties, vehicle blocks and depot utilisation on the same timeline. The most important relationships between empty trips, vehicle capacities, blocks and duties can be seen at a glance. The overview clearly shows the implications of changes to the cost specifications.
A cost evaluation of new agreements can be shown immediately. These example calculations can serve as a basis for decision making regarding the allocation of services or for the retention of work. The optimiser provides the option to create multiple duty and vehicle schedule variations (e.g. with shorter working times and breaks). The alternative plans can be used for negotiations with the various stakeholders. Daily optimisation helps to lighten the load on planning staff: employees can concentrate more on the creative aspects of their work. For unplanned events, such as road closures, the software is capable of creating special plans at short notice.

Day-to-day operations provide numerous options for cost control. MENTZ’s software helps support transport authorities in the optimisation process.

Existing duty and vehicle schedules can be read in and evaluated to see how minimal adjustment may affect the outcome. A planner determines how similar the result should be to the original. In order to assess potential savings, the optimiser creates new schedules and compares them to the existing cost base. Cost effective planning can take place without invalidating the existing agreements.

If a new internal rule is put into place, the software can analyse its impact in advance.

MENTZ software supports transport authorities in optimisation.

ANALYSIS AND ALTERNATIVE CALCULATION

Strategies to control costs

You need:

Savings, alternative calculations, estimation of the costs of operational changes, background information to inform future negotiations.

MENTZ provides:

All services related to optimisation, consultation, consideration of the operational conditions for optimisation, performing the optimisation runs, compilation of results and statistics.

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After Regensburg, Trier is the second city in Germany to introduce MENTZ E-ticketing. The simple-to-use smart phone app takes the cumbersome decision making out of the ticket purchasing process.

**Germany, Trier**

**Product**  
E-Ticketing-API in combination with ÖPNV mobile app

**Functionality**  
Mobile app, timetable information, ticket purchase and payment system

**Contact**  
scingnitz@mentz.net
Every transport authority has its own fare system – and no two systems are the same. This is the challenge in developing a digital ticket shop. In Trier, MENTZ was able to effectively manage 500 different fare zones for ticketing purposes. With the new e-ticket, even tourists and infrequent public transport users can conveniently purchase the right ticket.

The Transport Authority of the Trier Region (VRT) is a long-standing customer of MENTZ’s products. The VRT works with a relational fare which the MENTZ trip planner has been calculating for some time. The next logical step for Trier was to develop an e-ticket. This problem is, the region contains almost 500 fare zones, plus a number of exceptions that affect the calculation of tickets and fare levels. When purchasing a ticket, about 60,000 possible combinations must be taken into account – this might be the most complex fare system around.

The standard: ticket purchase from a planned trip

Ticket purchase from a planned trip is easy to implement. This is because the customer’s trip request contains all the information required for ticket purchase, such as the initial stop, fare zones and fare level for the selected trip. Passengers only have to confirm their selection and complete the purchase.

The challenge: direct purchase without trip planning

Purchasing directly when there are 60,000 possible combinations is a different ballgame. The VRT and Trier Public Utilities (SWT) who jointly operate the smart phone app and ticket shop believed it was too complex for customers to do this. That is, until the solution offered by MENTZ convinced them to change their minds. The key question is what a customer uses in order to buy their ticket. The usual combination of initial stop and price level is not enough information for a complex transport fares system in an authority like Trier. Even adding the destination stop doesn’t help. The combination of origin, destination and price level would be chosen by the passenger, without checking whether they corresponded to the applicable fare rules.

The solution: the intelligent ticket shop

In MENTZ’s intelligent ticket shop, all fare zone combinations are stored with their calculated fares. Customers select the fare zone of the origin and destination area when purchasing a day ticket and the app shows the respective fare. MENTZ implemented a similar solution for the Regensburg Transport Authority to determine the prices of day tickets (see MENTZ Magazine 1/2017). Regensburg only has 22 fare zones, which means that the number of possible combinations is quite manageable. In Trier, the 500 fare zones with about 60,000 possible combinations make for a considerably larger problem. But this challenge was met by MENTZ without having to sacrifice performance. To prevent the app from having to request every combination for each purchase from the ticket shop, it stores them internally in a database. The app then only has to retrieve the information once. This ensures consistently good performance when providing fare zone combinations. When fare zone combinations change in the ticket shop, the app is instructed to retrieve the new data and update the database entries.
MENTZ's e-ticketing solution provides both operators and customers with many benefits.

- Passengers no longer need to sift through complex fare structures. The intelligent ticket shop guides them through the fare zones and supplies the correct ticket.
- Cash and ticket machines are a thing of the past. Customers can purchase their tickets conveniently and without cash.
- Easy ticket purchase reduces one of the biggest obstacles to using public transport – especially for tourists and infrequent users.
- The digital ticket shop provides important basic data for sales statistics and market research.

Ticket purchase: convenient and cashless

This technology makes the direct purchase of tickets relatively easy for passengers: they select an origin, destination and optionally a via-zone, and the fare to be paid is automatically determined. If the purchase is made from the trip planner, the information is passed from the selected trip. Additionally, the initial stop is displayed on the ticket when purchasing from the trip planner. Another advantage is that, purchasing a ticket from the trip planner does not require any in-depth knowledge of the special fares in Trier. The passenger can select the best ticket from the trip which is presented, and only have to decide whether they need a single, a multi-trip or day ticket. The zones are passed (as part of the selection) and the related fares are determined by the trip planner and transferred to the shop. Passengers only have to confirm the information and complete the purchase. Payment transactions are handled securely by our partner LogPay Financial Services.

Data protection

The VRT and SWT manage customer and sales data in the administrative section of the ticket shop. This allows the progress of customer registrations and ticket revenue trends to be tracked and statistically analysed over a period of time. The topic of data protection – ever present due to the GDPR legislation – has been taken into full account in this solution. Abuse of the system is prevented by only permitting requests via https in combination with a valid authentication token generated by the shop for a valid user/password combination. Within the scope of customer data management, personal and sales data are stored in the shop. No bank account details are saved, not even temporarily during registration. All bank account related data are saved exclusively by the payment service provider.

In essence, all data is saved in an encrypted format in the app. This applies to the generated ticket and to the token required for authentication in the shop. No personal data are stored other than the name of the ticket holder, which is part of the ticket. Security and data protection for communications between the app and server are guaranteed by SSL-Pinning. The server’s SSL certificate is stored in the app and multiple certificates can be saved. As soon as a connection between the app and server needs to be established, the app checks whether the certificate sent by the server matches one of the certificates saved in the app. If a match is found, the connection is made. If the certificates don’t match, no connection is made. This process is able to prevent man-in-the-middle attacks.
User group with a new format

At the 62nd DIVA/EFA user group, we implemented several customer requests and tried a new event format: gone was the unpopular autumn date with its conflicts with the annual timetable change and introduced in its place was the combination of the previously existing two user groups into a single user group (UG) with differing foci. In order to avoid losing any content, the event schedule was partly organised into parallel sessions. This way our customers could plan their schedules according to their interests. Topic areas were limited to 15 – 30 minutes, thus adding a bit of pace to the presentations and allowing more time for discussions.

A completely new addition to the UG was the opportunity for developer consultation.

EFA on Sand

The classic stereotype of an IT specialist that is overweight, addicted to coffee, and a pizza junkie was never the case, at least not at MENTZ. In fact, a team of MENTZ EFA developers proved quite the opposite showing top form in this year’s B2BeachSoccer tournament in Munich. Their strong, fighting performance to –gether with a number of artistic bicycle kicks won them 5th place. Along the way they even beat the eventual tournament champs – the team representing the Bavarian Football Federation – by a score of 2:1.

We are currently looking to expand our EFA Team both on the football field and in the office.

Details at: www.mentz.net/en/about-us/working-at-mentz/job-openings
107 years later, all eyes of the transport community will be on Belfast once again when the maiden journey of the glider takes place in September 2018. What looks like a cross between a bus and tram should never be described as such. This is because it does not roll, it glides: “... the new, effortless and smooth way to travel, glide through city traffic and arrive fresh and ready on a modern and high tech mode of travel ...”

The goal is to reduce travel/glide time through the city by up to eight minutes while reducing the time between journeys to seven or eight minutes – and to increase comfort. On board, free WIFI and USB charging stations are available for up to 105 passengers. In addition, thanks to the low-noise and low-vibration diesel-electric hybrid motor, passengers can take care of tasks on their way to work without too many disturbances. Using a flexible data model, introducing the glider to DIVA and EFA was simple. The only change was creating a new MOT type in DIVA that controlled the vehicle’s display in publicity layouts and icons across various media (website, timetable and app). The fare changes were also entered into DIVAWEB without an issue.

We’re keeping our fingers crossed for a successful and ice-free maiden journey!
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Imprint

Editor
MENTZ GmbH
Grillparzerstraße 18
D-81675 München
Tel.: +49 (0) 89 41 868 - 0
Fax: +49 (0) 89 41 868 - 160
E-Mail: info@mentz.net
Internet: www.mentz.net

Editorial office
albertZWEI media GmbH
Rosemarie Mentz

Design
mattweis GmbH

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Our offices
MENTZ GmbH
Am Mittelhafen 10
D-48155 Münster
Tel.: +49 (0) 2501 70330 - 0
Fax: +49 (0) 2501 70330 - 300
MENTZ GmbH
Rotebühlstraße 121
D-70179 Stuttgart
Tel.: +49 (0) 711 61 55 43 - 0
Fax: +49 (0) 711 61 55 43 - 30
MENTZ GmbH
Georgenstraße 22
D-10117 Berlin
Tel.: +49 (0) 30 206 73 56 - 606
Fax: +49 (0) 30 206 73 56 - 70

Our affiliates
MENTZ Austria GmbH
Mariahilfer Straße 106
1070 Wien, Österreich
Tel.: +43 (0) 1 5 81 30 42 - 10
Fax: +43 (0) 1 5 81 30 42 - 20
E-Mail: info@mentz.net
MENTZ Datenverarbeitung Schweiz GmbH
Badenerstrasse 530
8048 Zürich, Schweiz
Tel.: +41 (0) 43 81863 - 11
E-Mail: info@mentz.net

mdv Australia Pty. Ltd.
ABN 22134144326
PO Box 682,
Templestowe, 3106
Australia
Tel.: +61 (0) 437 241 927
E-Mail: info-aus@mentz.net

mdv software for public transport Ltd.
PO Box 192
Felixstowe
IP11 1 BF
United Kingdom
E-Mail: kunde@mentz.net

Mentz Middle East FZCO
PO Box 371123
E1-411 (DAFZA), Al Tawar 1
Deira, Qusais,
Dubai, UAE
Tel.: +971 52 835 1926
E-Mail: mme@mentz.net