

**RFID TO USE CUSTOMERS OF SERVICE
ZASTOSOWANIE RFID DO OBSŁUGI KLIENTA**

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Abstract: Maintenance services are an important role of customer office processes, starting at sales and ending utilization. The paper analyzes communications ways of consumer with central service, focused on presentation mobile application to identify the most efficient form of service orders.

Streszczenie: Usługi serwisowe odgrywają ważną rolę w procesach biurowych, rozpoczynając od sprzedaży i kończąc wykorzystanie. W artykule przedstawiono analizę sposobów komunikacji konsumentów z usługą centralną, koncentrując się na prezentacji aplikacji mobilnych w celu zidentyfikowania najbardziej skutecznych zamówień na usługi.

Keywords: service orders, using RFID, NFC, interface of customer and service

Słowa kluczowe: zlecenia usług, przy użyciu RFID, NFC, interfejsu klienta i usługi

INTRODUCTION

The service market is probably the most profitable part of businesses, if this appliances are enough expensive then repairs are more profitable than buying a new machine. A company that specializes in the production of professional household appliances and consumer products. The company is also servicing machines mainly by own technicians, in some areas authorized company. Authorized servicers repair not only the equipment of one company but other manufacturers. The research problem is communication between the service, the service technician and the customer.

1. SERVICE MARKET OF HOUSEHOLD DEVICES

Performance a comparison of the German and Polish markets requires a lot of tolerance because of the many differences between them. Namely, the average salary of an employee in Poland is 4400 PLN, according to GUS data from 2016 and in Germany 1500 EURO (around 6540 PLN), unfortunately in Poland less customers can afford to buy expensive and exclusive equipment.

The table below presents the analysis of the given values, in results are a statistical number of customers per one technician in Poland and Germany..

Table 1 Comparative analysis of the domestic appliances market in Poland and Germany

Parameters	Germany	Poland
Total number of technicians	352	11
Number of sold machines (years 2006-2016.)	5 857 000	140 000
Number of machines per technician	16 639	12 727
Theoretical number of consumer (number of sold machines / number of machines per technician)	3,2	2,1
Statistical number of consumers per technician	5 200	4 500

Source: Own compilation

Number of technician in Poland is 30 times less than in German but in German technician have to cover more items in the market. Improved the service process is dynamic and constantly adjusted to the market.

2. NFC STANDARD

NFC standard (Near Field Communication) called short-range communication. NFC technology provides convenient, fast and secure transfer of digital data over high frequency radio at short distances between devices. Devices must meet the ISO / IEC 14443 standard that defines the proximity card used to identify the user and the transmission protocols used when communicating with them. Use of this standard allows you to download data from devices that are equipped with TAG-NFC. Wireless communication between devices takes place at a maximum distance of 0,2 m. In NFC technology we distinguish two modes of operation:

- Active mode – device is able to distribute electromagnetic field during data exchange. Is equipped at own power supply.;
- Passive mode – device is unable to distribute electromagnetic field during data exchange. Need to be powered by device in active mode.

Active mode: figure 1 - when both device (initiate and slave device) communicate by alternating generation of own signal. The device switch off its electromagnetic field when it waits for data. In this mode, both devices usually need power.



Fig. 1 Active mode
Source: Own elaboration

Passive mode: figure 2 - In this case, the initiating device generates the electromagnetic field and the slave devices correspond to modulating this field. In this mode, the slave device is powered by the electromagnetic field of the initiating device, making the slave device works as a transponder.



Fig. 2 Passive mode
Source: Own elaboration

The encoding method and modulation depend on the mode used. NFC technology uses magnetic induction, electromagnetic fields contain antenna antennas and exchanges data on the basis of questions and answers. The frequency at which the device can operates is 13.56 MHz, with a bandwidth of 14 kHz (figure 3, column 6).

Possible transmission speeds are: 106, 212, 424 or 848 kbit / s.

	Bluetooth	Bluetooth LE /Smart	WIFI	WIFI	WIFI (Next generation)	NFC	Zigbee	Z-Wave	ANT +
<i>Specification</i>	802.15.1	802.15.1	802.11g	802.11n	802.11y	NFCIP-1	802.15.4	Z-Wave alliance	ANT
<i>Frequency</i>	2.4 GHz	2.4 GHz	2.4 GHz	2.4GHz / 5 GHz	3.7GHz (US)	13.56 MHz	868 MHz (EU) 915MHz (US) 2.4GHz	868MHz (EU, China, India, Russia,...) 900MHz (North America, Brazil, HongKong, Australia, Japan,...)	2.4GHz
<i>Range indoor (m)</i>	30	10	25	50	50	0.2	30	45	10
<i>Range max (m)</i>	100	50	75	125	5000	0.2	1500	150	30
<i>Data speed max</i>	3 Mbit/s	1 Mbit/s	54 Mbit/s	540 Mbit/s	54 Mbit/s	424 kbit/s	250 kbit/s	100 kbit/s	<100kbit/s
<i>Data speed typ.</i>	2.1Mbit/s	270 kbit/s	25 Mbit/s	200 Mbit/s	23 Mbit/s	2.5kbit/s	150 kbit/s	40 kbit/s	20 kbit/s
<i>Peak current</i>	150 mA	20mA	150 mA	150 mA	-	15 mA	50 mA	20 mA	35 mA
<i>Sleep current</i>	5 mA	1 uA	100 µA	100 µA	-	10 µA	5 µA	2.5µA	1 µA
<i>Battery life</i>	Month	Year	Day	Day	-	Month/Year	Month/Year	Year	Year
<i>Network topologies</i>	Star	Star	Star	Star	Star	Peer to peer only	Star, Tree, Mesh	Star, Tree, Mesh	Star, Tree, Mesh
<i>Typically :</i>	- Headsets - Computer peripherals	- Mobile phones - Sport trackers - Health devices - Wireless sensors	- PC (networking) - WLAN	- same as 802.11g with improved performances - Outdoor LAN	- wireless link between hotspot	- transport ticket - secure payment - door opening	- home automation - wireless sensor networks - smart metering	- home automation	- sport trackers - Health devices
<i>Official Website Link</i>	https://www.bluetooth.org/en-us	https://www.bluetooth.org/en-us	http://www.wi-fi.org/	http://www.wi-fi.org/	http://www.wi-fi.org/	http://www.nfc-forum.org/home/	http://www.zigbee.org/	http://www.z-wave.com/	http://www.thisisant.com/

Fig. 3 Standard cooperation

Source: <http://www.wi6labs.com/2016/03/16/quelle-technologie-radio-pour-les-objets-connectes-deuxieme-partie/>

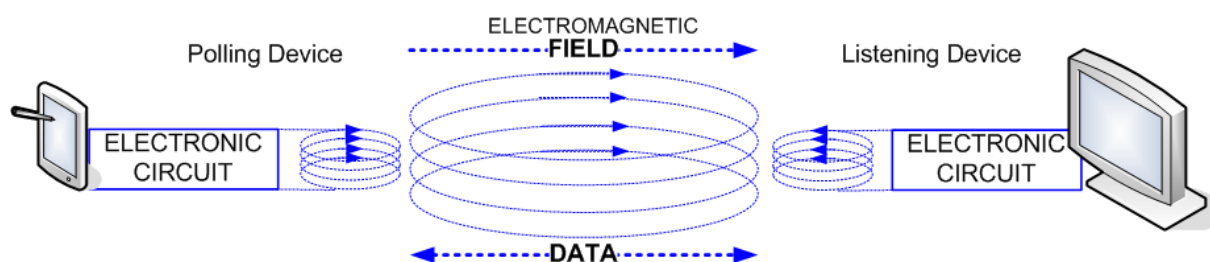


Fig. 4 Communication modes of NFC

Source: Own elaboration

According standard, technology NFC can work in three modes present figure 4:

- **Read/Write** – in this mode NFC device read information from electronic tags:
- **Peer-to-Peer** – in this mode two NFC device exchange the information (for example: two mobile phones synchronized contacts or media files)
- **Card Emulation** –in this mode device work like „standard card” commonly use like tickets of payment cards.

Radio technologies communicate in query and response mode, which means that the parent device sends queries to devices near and devices within the range of the electromagnetic field respond. The commencer device tag the target devices (draft 1 and 2). The slave device sends a response to the initiator that it is ready to send data. Once the notification is ready, data is exchanged between devices.

The active device transmits data using the ASK (Amplitude Shift Keying) modulation. This means that the carrier frequency is modulated by the data stream according to the selected coding scheme. Data transmitted at 106 kbps is encoded using a modified Miller algorithm, while for higher speeds the Manchester coding is used, except that modulation of the carrier frequency of 13.56MHz occurs at a transmission speed of more than 106kbps in Table 2.

Table 2. Transfer speed per used signal type.

Transfer speed	Signal code
106 kb/s	Modified Miller code
212 kb/s	ASK Manchester code
424 kb/s	ASK Manchester code
848 kb/s	ASK Manchester code

Source: Own compilation

Ways to use:

- Entrance to house
- Remote starting computer
- In bookstore. Tag which located on the cover or on the shelf let on fast get acquainted with reviews of this book, book's author or his composition
- In museums. Tags placed at exhibits can provide their broader description
- At bus stops, in public transport
- At information points
- To exchange contact details between phones
- For printing
- In work/ Office to printing. Usually some printers can have proximity card leader
- For payment. You can pay with used NFC in the shop or for parking and in public transport
- For open the door

3. NETWORK SYSTEM OF SUPPORT SERVICE OF HOUSEHOLD PRODUCTS

Parameter which condition working service are break down devices as a result of inadequate and unsuitable. What is more, issue of consumption resulting from approaching end process exploitation have some influence for occurrence fault too. Unfortunately, a human still does not construct an engine which will has hundred percent of efficiency and therefore, devices are repaired and maintained to prolong their vitality.

Analyse diagram below, which shows different forms of contact customers with service and process of reporting problem with device. In exemplary enterprise customer possess three possibility to contact with service:

1) Using phone

Customer reports some fault at Call Center where he must give your address data, contact details, short description about symptoms of fault his device and specific

information like model, type and serial number. The most important thing about device is information what is wrong with customer's washing machine or dishwasher. It can help to identify problem and define the best solution.

After registration, an application was convey for message technician which must properly prepare for the reparation for example: order necessary spare parts. Subsequently, some person of Call Center should give a call in order to determine suitable term of technician's visit. If both parties match proposed data- the fault is being eliminated. This is climax of process service request.

2) Using e-mail

First step which customer should make- set the address mail on which service requests are sent. In message he should conclude all information which will be give similarly like over the phone (address, model, symptoms etc.). If necessary data would not conclude in one mail- process of reporting will become increasingly longer. When the message appears on inbox, she will be assigned to responsible employee which deal with orders service. Contrariwise than in case of a telephone line that employee gets in touch with technician and a customer in order to set a term.

3) Using mobile application

It is safe to say that this way is the most convenient and the fastest method to order some defect. Without interference unnecessary person, a form is filled and contains four the most important aspects:

- Mode
- Type
- Characteristic of symptom/ defect
- Requested data of repair

Additionally, waiting time on service confirmation is limited to minimum because of that person, who reports a fault, receives automatically after end fill form.

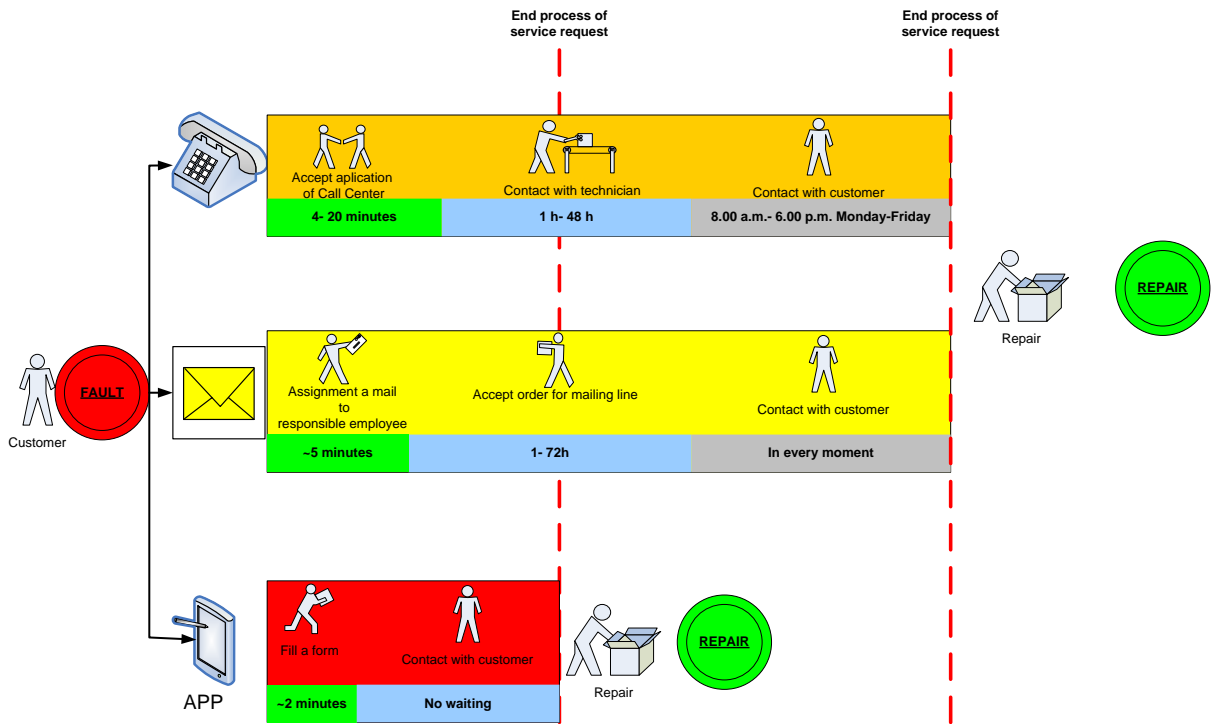


Fig. 5 Options to report repair

Source: Own compilation

Below was posted a table which compare three options service reporting with each other. Analyzed factors are: average reporting time, estimated length waiting on confirmation about service request and possibility announcing a fault. Proposal is simple and clear. The best option to report some problem is order by mobile application.

Table 3. Orders

Analyzed factor	Option nr 1 (Using telephone)	Option nr 2 (Using e-mail)	Option nr 3 (Using mobile application)
<i>Average reporting time</i>	4-20 minutes (with time to connect with Call Center)	~ 5 minutes	~2 minutes
<i>Estimated length waiting on confirmation about service request</i>	1-48hour (depend on time working of technician)	1-72hour (taking into account the applications during free days)	no waiting time
<i>Possibility announcing a fault (In a time frame)</i>	Monday-Friday 8 ⁰⁰ a.m.-6 ⁰⁰ p.m.	in every moment	without limit time

Source: Own compilation

4. APPLICATION NFC – RFID IN APPLIANCES AGD

Companies have a system base data containing information about equipment and customers. The biggest problem is possession by customer service documentation with invoices purchase. Quantity devices which we have is nowadays big. Using already existing bases data and connect their with new technologies can give a lot of profits to enterprises and what is more, this way can simplify a life of customers using some devices. Pictures 6 shows application of technology NFC-RFID and Smartphone to communicate with Server service, which administer Household Products.

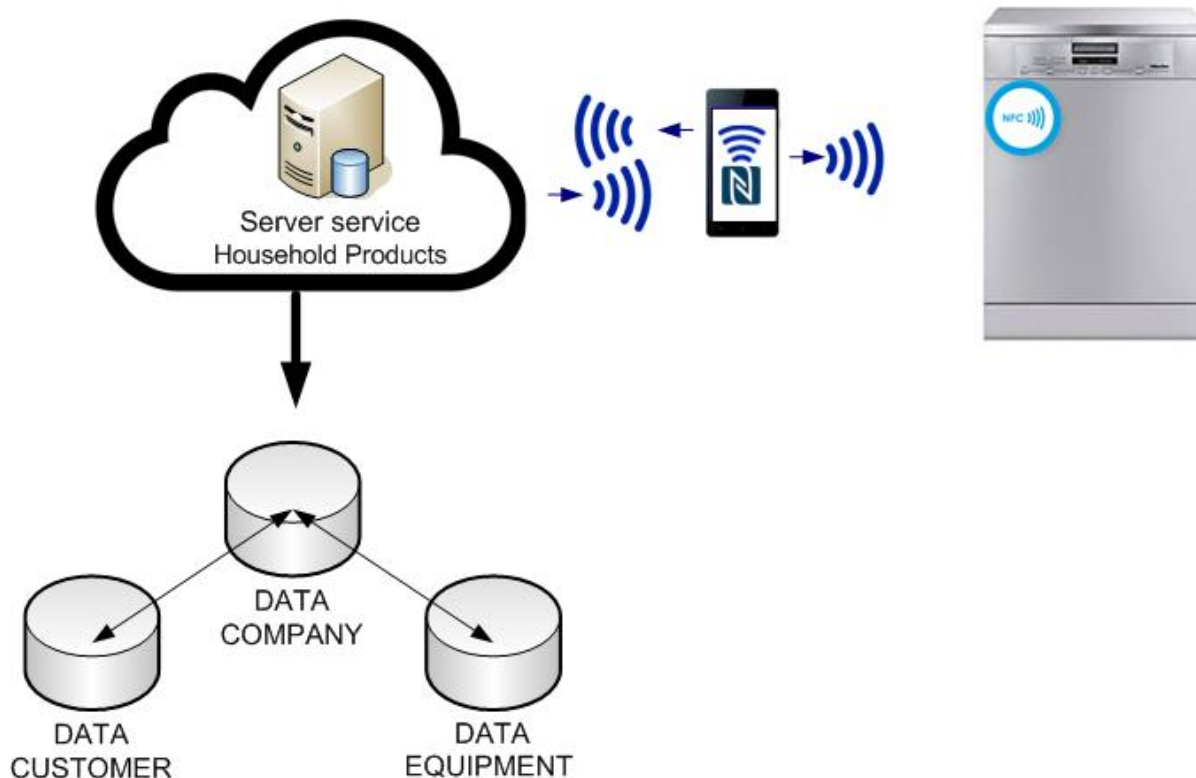


Fig. 6 Communication NFC-RFID

Source: Own compilation

To respectively use Server service, which is connected with data equipment, data customer and data company, should install an application in all system. She will be mediate between customer and service (figure 5). This way of reporting is faster and more comfortable for both parties thanks to flexibility of determine service repair and matching technician to customer's possibility of time.



Fig. 7 Visualization of panel HANDYMAN APP

Source: Own compilation

A Functioning HANDYMAN APP- figure 7 based on using technology RFID and NFC in order to automatic obtaining information about equipment. This information will help user to fill different of type form like:

- Installation new device
- Service repair
- Service conservation
- Exchange filters, capsules for descaling, etc.

This method will simplify communication with authorizes service. User does not have obligation of remembering if his devices has still guarantee. What is more, customer does not keep a lot of paper with serial number, type and model his devices. It is simple- only need to close closer telephone with function near field communication (NFC) and all information, which are necessary, will be loaded into the application and transfer to suitable form choosing by customer. This way sends to service exact parameters of device and registers request at base with recognition of user and device. This program will localize the nearest technician like on the picture 8. Technicians was marked on the map- yellow stars which means that he can pick up application. Human icon of red color means users which want order a service. What is more, HANDYMAN APP shows what distance is located authorized service.

Depending on the type of service was ordered, nearest technician can do overview through phone interview or take on this repair.

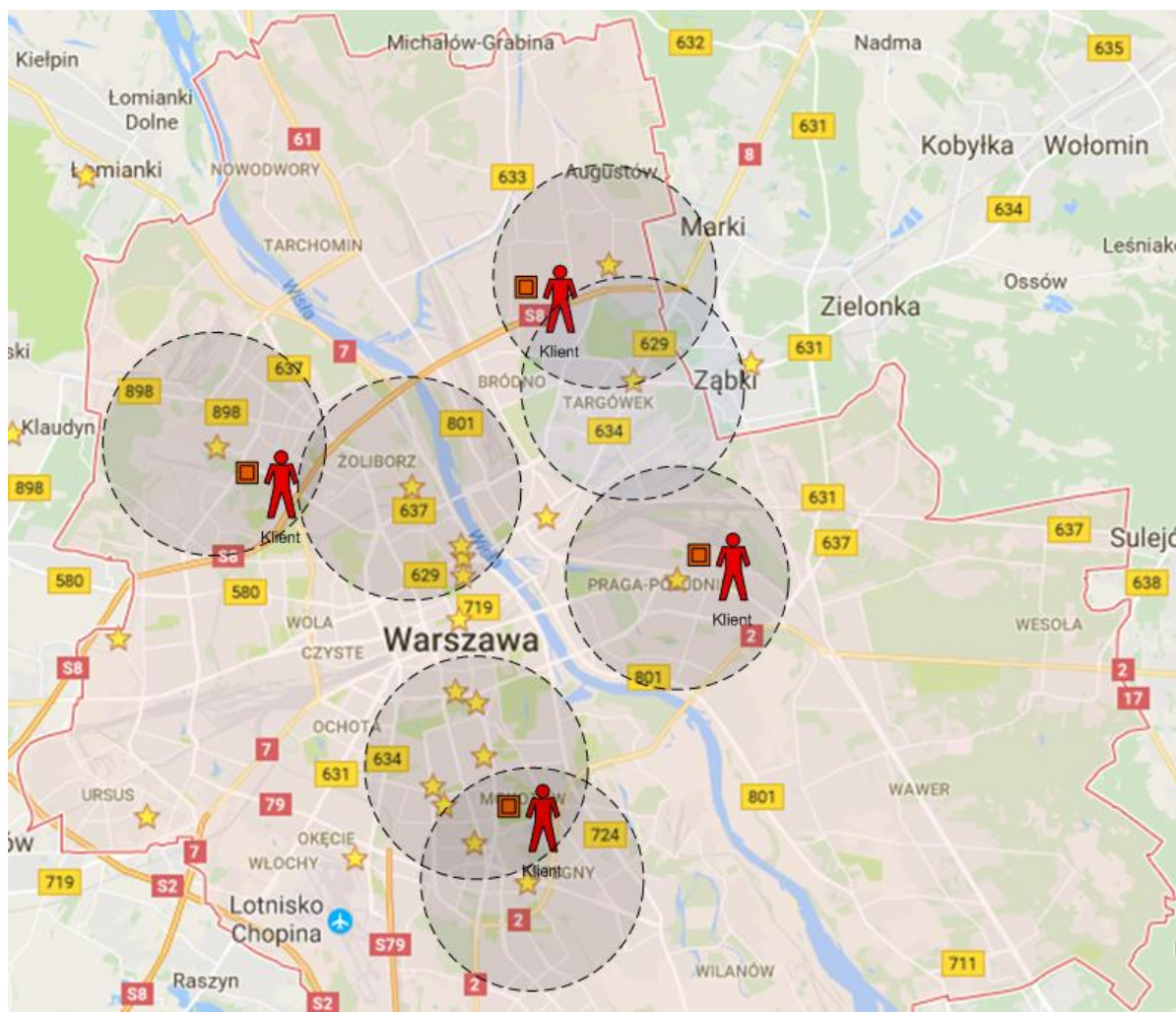


Fig. 8 A map showing localization the nearest technicians
 Source: Own compilation

User can choose online a technician, which is the nearest him. At the moment of choice, service data appears such as first name, last name, telephone number and photo like figure 9. Identifier with a photo and telephone number owns extra TAG NFC-RFID (figure 10) which will be served to receive service by user. This form let for eliminate paper version because of that a session will be closed automatically and will show how fast a technician managed with fault from the line of filling. This idea let for make a knowledge base of fault which will be used in the future.

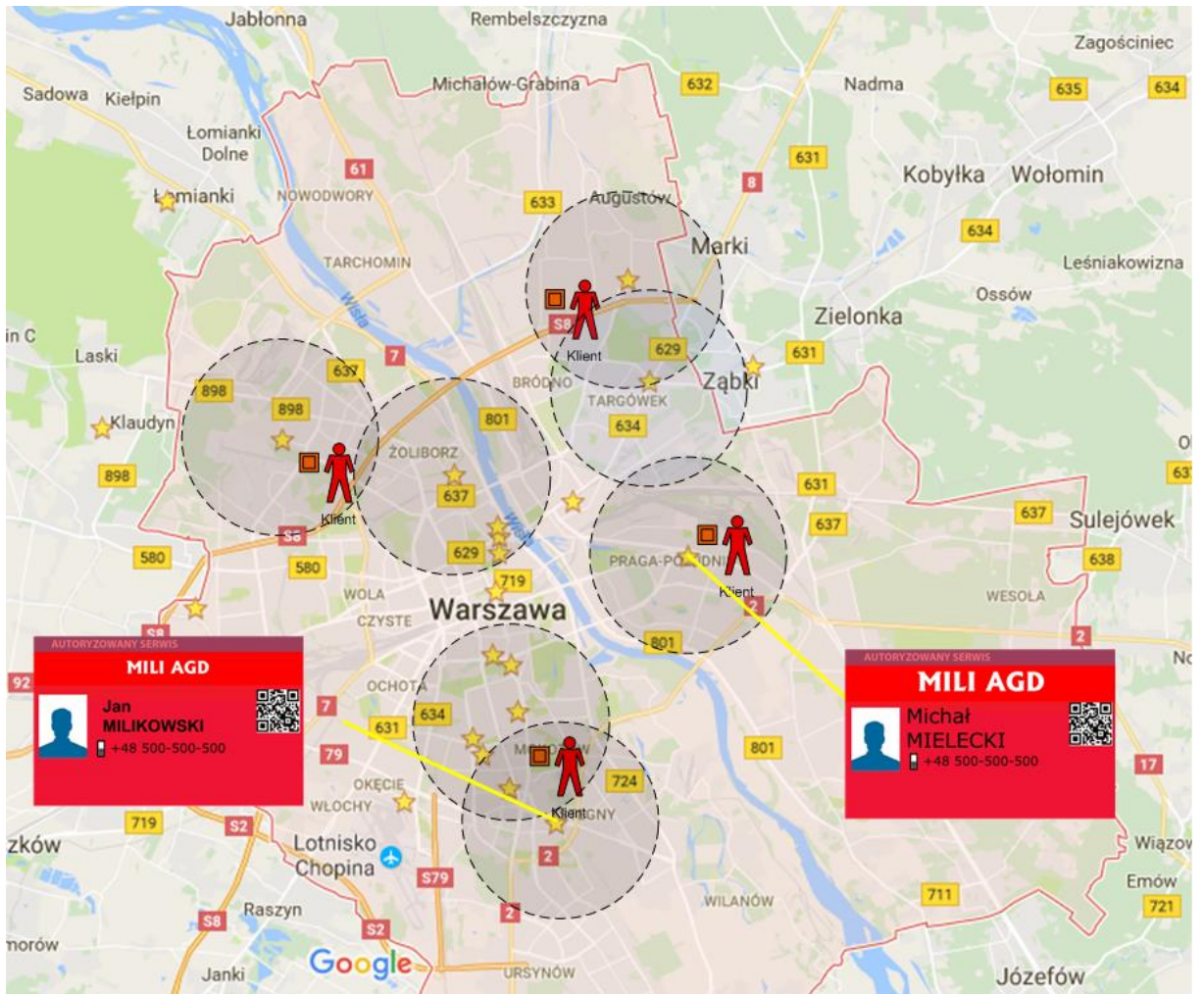


Fig. 9 Service contact details
Source: Own compilation

The Service Identifier will to be a guarantee that it is the service technician, who was ordered by the customer.



Fig. 10 Service Identifier
Source: Own compilation

Connection application of customer with service base data lets to improve servicing equipment. As a result of that customer is satisfied and finally, an enterprises have satisfactory opinions among consumer.

6. SUMMARY

Companies want to gain an edge over Rother companies must compete on the market of service. To maintain your position should invest in new technologies and later implement modern solutions, which will be improved work in service. Problem which was examined raises the question: „Are we enough innovative as a result we do not scare to implement new solutions?”.

Companies focused on modernization of devices, but this part is make by outside companies based on outsourcing but they do not have enough time to analyse way of functioning service request. Problem which was examined based on long-term experience of employees, which manage work in service.

An implementation this idea lets company gains advantage over the competition. Obviously, further research will show if this kind of way is profitable and if is possibility of implementation in every department on the world.

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