Implementation of the Algorithm for Checking and Registering Mobile Devices in the Information System Using the IMEI Code

Davronbekov Dilmurod Abdujalilovich, Khakimov Zafar Tulyaganovich, Isroilov Jamshid Dilshodovich

Professor, Technologies of Mobile Communication department, Tashkent University of Information Technologies named after Mukhammad al-Khwarizmi, Tashkent, Uzbekistan

Phd researcher, Technologies of Mobile Communication department, Tashkent University of Information Technologies named after Mukhammad al-Khwarizmi, Tashkent, Uzbekistan

Director of Center for Higher Education Development Research and Introduction of Advanced Technologies, Tashkent, Uzbekistan.

ABSTRACT:This article provides an algorithm for checking and registering IMEI codes of mobile devices, differentiating IMEI codes into "white", "gray" and "black" lists, comparing the database of registered and monitoring new IMEI codes. To implement an information system for registering mobile devices by IMEI code, hardware and software complexes.

KEY WORDS: IMEI-код, registration, information system, database, mobile device, roaming.

I.   INTRODUCTION

Currently, in many countries, research is being carried out aimed at developing the structure and organization of a database of identification codes for mobile devices, methods and algorithms for identifying mobile devices. Systems for streamlining the accounting of mobile devices are beginning to be actively used. In this direction, one of the priority and demanded is the task of developing and implementing a registration system for mobile devices based on the international identification codes of mobile devices IMEI - International Mobile Equipment Identity. IMEI is a number (usually 15-digit decimal) that is unique to each device using it. It is used in cell phones of networks, as well as in some satellite phones. a cardinal approach to the implementation of the task. IMEI number was designed to uniquely identify an individual mobile device, hackers have designed various methods to change the IMEI number of mobile devices so that lost or stolen mobile devices doesn't located by the securities agencies, causing the IMEI scams which had brought loss of data and property. Various hardware flashers devices and software tools are invented designed by the hackers which are easily available on internet. Thus it is important to stop and prevent such theft[1-25].

II. MAIN PART

To implement an information system for registering mobile devices by IMEI code, software and hardware complexes are required located in a data processing center with high performance and fault tolerance.

The developed information system is implemented as a software solution with a single database of mobile devices and with the ability to administer and assign user roles (Fig. 1).

The unified information system of IMEI codes of mobile devices is integrated with cellular operators to accumulate operating mobile devices on the territory of the state with mandatory registration[1-7].

The formation of the database is carried out by import-export of the collected (parsing) data, or by loading from the database of cellular operators. Implemented the ability to integrate the API in the provision of access by the mobile operator with the ability to lock or the user may lock the notification leads to the expected result (Figure 2).
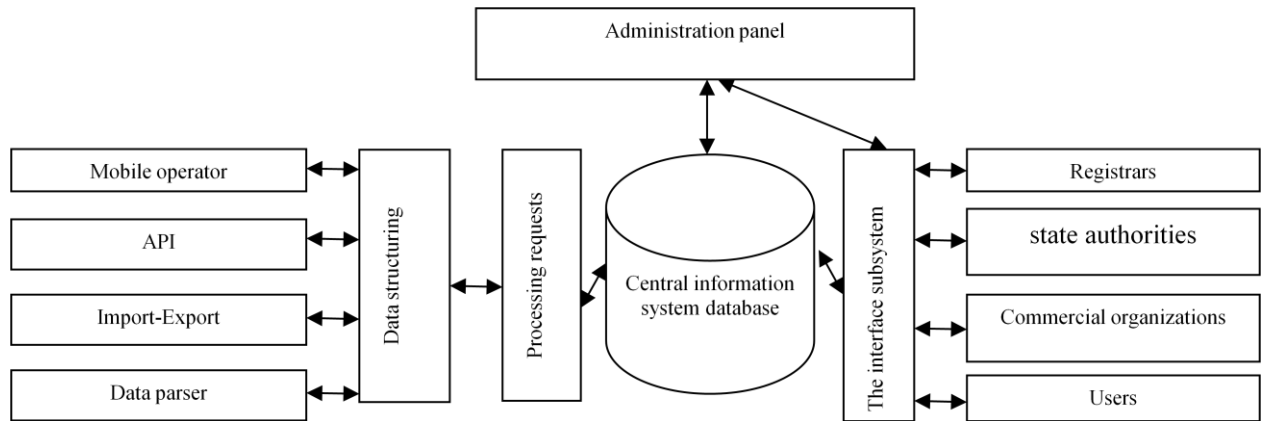
Fig. 1. Information system block diagram

For the implementation of the lock in the system elaborated a mechanism for applying the rules for compliance with international legal IMEI-codes producers. Thus, the IMEI code is placed in the corresponding list, of which there are three in the information system - "white", "gray" and "black" lists.

The information base provides the ability to quickly search for the necessary mobile devices in the networks of mobile networks.

Figure 2 shows a generalized algorithm for checking the IMEI code of mobile devices.
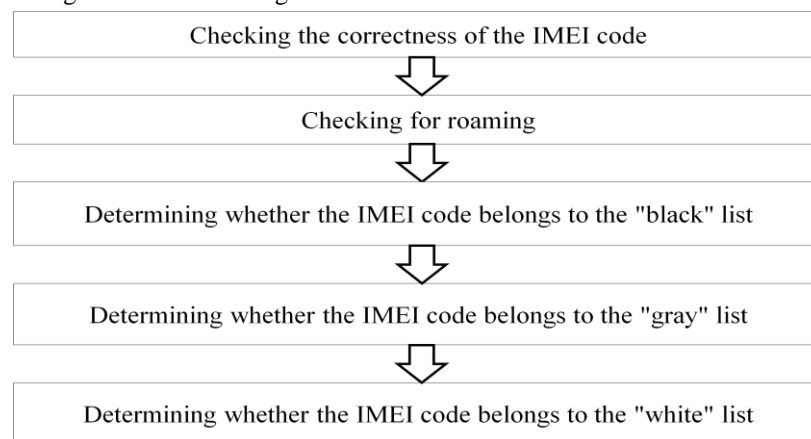

Fig. 2. Generalized algorithm for checking IMEI code

The main lists used to implement IMEI control have the following operating logic:
- checking the IMEI code for correctness during registration;
- checking the IMEI code for "roaming";
- "black" list - denial of service to subscriber devices in the cellular network, except for some special cases, for example, roaming;
- "white" list - full functionality of subscriber devices in the cellular network;
- "gray" list - mobile devices temporarily functioning in cellular networks [1-15].

An algorithm for checking and registering the IMEI code of mobile devices in the information system was developed, which is shown in Fig. 3.
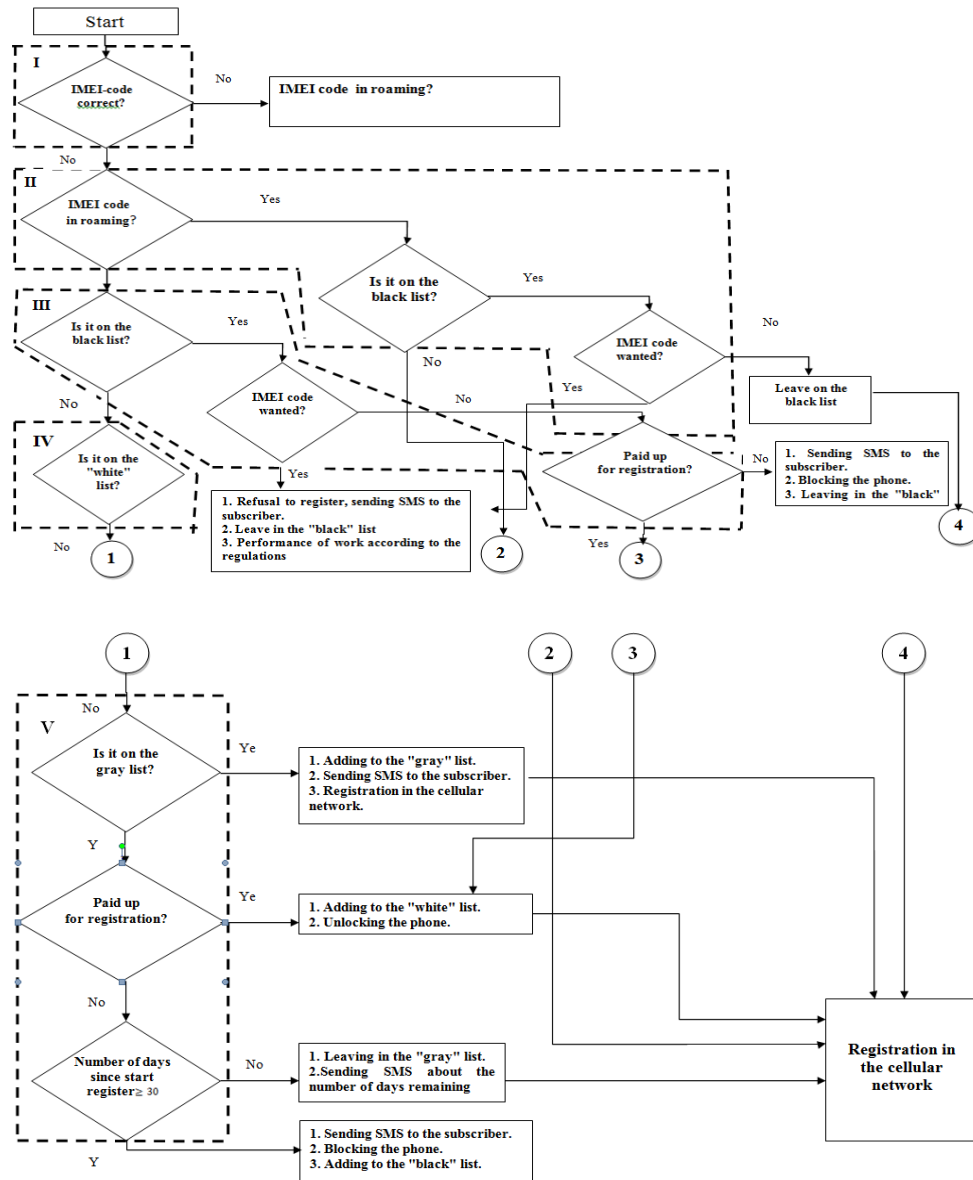
Fig. 3. Algorithm for checking and registering IMEI-code

The algorithm consists of five modules and 20 blocks. The algorithm works as follows.

Module I. Checking the correctness of the IMEI code.

Includes block 1. Here, the correctness of the IMEI code is checked. Mobile device. If the IMEI code is incorrect, then a transition to block 12 occurs.

Block 12 does the following:

1. Sending an SMS to the subscriber about the incorrectness of the IMEI code.
2. The mobile device is blocked.
3. Adding the IMEI code to the black list.

If the IMEI code is correct, then you go to module II, block 2.

Module II. Check if the IMEI code is roaming.

Includes blocks 2, 3, 4.

If the IMEI code is roaming (block 2), then the transition to block 3 occurs.

The block determines whether the roaming IMEI code is in the black list. If the roaming IMEI code is in the "black" list, it is determined why the IMEI code is there. Two situations are possible (block 4):

- Wanted IMEI code;
- The IMEI code was blacklisted for registration.

If the roaming IMEI code is wanted (block 4), then you go to block 13, where the following actions are performed:

1. Refusal to register a mobile device, sending an SMS to the subscriber about refusal to register.
2. The IMEI code remains on the black list.
3. Work is carried out with wanted IMEI codes according to the regulations.

If the roaming IMEI code is not on the wanted list, then this IMEI code is included in the black list by registration. Then block 14 is executed ("IMEI code remains in the" black "list") and the transition to block 20 ("Registration of IMEI code in the cellular network").

If the IMEI code is not roaming, but the IMEI code of the country of registration, then the transition to Module III takes place.

Module III. Check if the IMEI code is in the black list of the registrar's database.

Includes blocks 5, 6, 7.

In block 5, it is determined whether the IMEI code is in the black list. If the IMEI code is on the black list, then the next step is to determine if the IMEI code is on the wanted list (block 6). If the IMEI code is wanted, then the following actions are performed (block 13):

1. Refusal to register a mobile device, sending an SMS to the subscriber about refusal to register.
2. The IMEI code remains on the black list.
3. Work is carried out with wanted IMEI codes according to the regulations.

If the IMEI code is in the "black" list, but not wanted, then the payment for registration is checked (block 7). If payment for registration is made, then the following actions are performed (block 17):

1. Adding the IMEI code to the "white" list.
2. Unlocking the mobile device and going to block 20 ("Registration in the cellular network").

If the registration has not been paid for, then go to block 16 and the following actions are performed:

1. Sending an SMS to the subscriber about refusal to register.
2. Blocking a mobile device.
3. Leaving the IMEI code in the black list.

If the IMEI code is not in the black list, then the transition to the execution of Module IV takes place.

Module IV. Check if the IMEI code is in the "white" list of the registrar's database.

Includes block 8.

If the IMEI code is in the "white" list, then the transition to block 20 occurs and the registration of the mobile device in the cellular network is performed.

If the IMEI code is not in the "white" list, then the transition to Module V.

Module V. Checking if the IMEI code is in the "gray" list of the registrar's database.

Includes blocks 9, 10, 11.

Block 9 - checking is the IMEI code in the gray list. If the IMEI code is not in the "gray" list, then the IMEI code is added to the "gray" list, since the conditions of the "black" (Module III) and "white" (Module IV) lists were not met before.

The following actions are performed (block 15):

1. Entering the IMEI code into the "gray" list.
2. Sending an SMS to the subscriber about entering the IMEI code into the "gray" list and the need to pay within 30 days.
3. Registration in the cellular network.

If the IMEI code is in the "gray" list, then a check is made about the payment for registration (block 10). If payment for registration is made, then the following actions are performed (block 17):

1. Adding the IMEI code to the "white" list.
2. Unlocking the mobile device and moving to block 20 ("Registration in the cellular network").

If payment for registration has not been made, then a check is performed how much time has passed since the first registration of the IMEI code in the registrar's database (block 11).

If the number of days does not exceed 30 days, then the following actions are performed:

1. The IMEI code remains in the gray list.

2. An SMS is sent to the subscriber about the number of days left until the end of registration (block 18) and the registration of the mobile device in the cellular network is performed (block 20).

If the number of days from the beginning of the first registration has exceeded 30 days, then the following actions are performed (block 19):

1. An SMS is sent to the subscriber that the number of days after the first registration has exceeded 30.
2. Blocking a mobile device.
3. Adding the IMEI code to the black list[1-25].

III.   CONCLUSION

Thus, the developed algorithm and method for checking and registering mobile devices by IMEI code allow you to do the following:
- check the IMEI code during registration for correctness;
- determine the IMEI code of a mobile device in roaming;
- to differentiate IMEI codes into "white", "gray" and "black" lists;
- compare the database of registered and monitor new IMEI codes.

The developed algorithm and methodology for checking and registering mobile devices by IMEI code are implemented practically in the form of a real operating information system.

REFERENCES

[1]   Yu.V. Banin, D.M. Kizilov. D.E. Namiot about finding the owner of a mobile phone, International Journal of Open Information Technologies ISSN: 2307-8162 vol. 2, no.8, 2014, http://injoit.org/index.php/j1/article/view/135

[2]   Namiot D., Sneps-Sneppe M. On Database for Mobile Phones Ownership.Proceedings of the 15th Conference of Open Innovations Association FRUCT, Saint-Petersburg, Russia. Publisher ITMO university publisher house, ISBN 978-5-7577-0463-0

[3]   D. Davronbekov, A. Kiriakidi, D. Yelkin, J. Isroilov, M. Nurmatova. State And Analysis Of The Mobile Devices Market For Creation Of Uniform Base Of Identification Of Mobile Devices On IMEI, SCIENCE AND WORLD, International scientific journal,№ 11 (63), 2018, Vol. I

[4]   D. Davronbekov, K. Abdurakhmanov, Z. Khakimov, J. Isroilov, A. Kiriakidi, D. Yelkin. Some Issues Of Registration And Accounting Of Mobile Devices By IMEI, Science and World International Scientific Journal № 8 (72), 2019

[5]   Davronbekov D.A.,IsroilovJ.D., Akhmedov B.I. Principle of organizing database identification on mobile devices by IMEI, International conference on information science and communications technologies applications, trends and opportunities, 4-6 november, 2019year.Scopus indexed, ICISCT 2019, www.icisct2019.org/] DOI: 10.1109/ICISCT47635.2019.9012000.

[6]   Davronbekov.D.A., Sultonova.M.O.,Isroilov.J.D, "Analysis of software determination IMEI mobile devicesв"3(9)/2019, Descendants of Mohammed Al-Khwarizmi, Scientific-practiacal and information-analiytical journal.p.67-71

[7]   Davronbekov.D.A., Sultonova.M.O.,Isroilov.J.D, "IMEI system for protection of mobile terminals" Descendants of Mohammed Al-Khwarizmi, Scientific-practiacal and information-analiytical journal.ISSN-2181-9211 3(5)/2018, p.94-97.

[8]   Xusanovna, T. D., Imomaliyevna, K. L., &Baxadirovna, F. B. (2020). Sensor networks and their development algorithm. Journal of Critical Reviews, 7(12), 952-954. doi:10.31838/jcr.07.12.167.

[9]   Davronbekov.D.A.,Aliev .U.T.Isroilov.J.D. Using the energy of electromagnetic radiation as a source of power // International Conference on Information Science and Communications Technologies (ICISCT) Applications, Trends and Opportunities, 2nd, 3rd and 4th of November 2017, Tashkent, Uzbekistan. (Scopus) DOI: 10.1109/ICISCT.2017.8188565

[10]   Pulatov.Sh.U, Aliev.U.T.Isroilov.J.D.. Energy harvesters wireless charging technology // International Conference on Information Science and Communications Technologies (ICISCT) Applications, Trends and Opportunities, 2nd, 3rd and 4th of November 2017, Tashkent, Uzbekistan. (Scopus) DOI: 10.1109/ICISCT.2017.8188566

[11]   Davronbekov.D.A., Aliev .U.T.,Isroilov.J.D., Alimdjanov X.F. Power providing methods for wireless sensor // International Conference on Information Science and Communications Technologies ICISCT 2019, Tashkent, Uzbekistan - 2019. (Scopus) DOI: 10.1109/ICISCT47635.2019.9011850

[12]   I.Kh. Siddikov.,Kh.A. Sattarov.,Kh.E. Khujamatov., O.R. Dekhkonov. Modeling the processes in magnetic circuits of electromagnetic transdusers // International Conference on Information Science and Communications Technologies ICISCT 2016, 2nd, 3rd and 4th of November 2016, DOI: 10.1109/ICISCT.2016.7777393.

[13]   SiddikovI.Kh. SattarovKh.A. KhujamatovKh.E. Dexkhonov O.R. Agzamova M.R. Modeling of Magnet Circuits of Electromagnetic Transducers of the Three-Phases Current//2018 XIV International Scientific-Technical Conference on Actual Problems of Electronics Instrument Engineering (APEIE-2018), October 2-6, 2018, Novosibirsk. –p.p. 419-422 (Scopus) DOI: 10.1109/APEIE.2018.8545714

[14]   Muradova A.A. KhujamatovKh.E. Results of Calculations of Parameters of Reliability of Restored Devices of the Multiservice Communication Network // International Conference on Information Science and Communications Technologies ICISCT 2019, Tashkent, Uzbekistan - 2019. (Scopus) DOI: 10.1109/ICISCT47635.2019.9011932

[15]   KhujamatovKh.E. Khasanov D.T., Reypnazarov E.N. Modeling and Research of Automatic Sun Tracking System on the bases of IoT and Arduino UNO // International Conference on Information Science and Communications Technologies ICISCT 2019, Tashkent, Uzbekistan - 2019. (Scopus) DOI: 10.1109/ICISCT47635.2019.9011913

[16]   KhujamatovKh.E. Khasanov D.T., Reypnazarov E.N. Research and Modelling Adaptive Management of Hybrid Power Supply Systems for Object Telecommunications based on IoT // International Conference on Information Science and Communications Technologies ICISCT 2019, Tashkent, Uzbekistan - 2019. (Scopus) DOI: 10.1109/ICISCT47635.2019.9011831

[17]   Toshtemirov, D., Muminov, B., Saidov, J. Fundamentals of compilation of electronic tasks for students to test and strengthen their knowledge of database. International Journal of Scientific and Technology Research 9(4), c. 3226-3228. 2020.

[18]   Muminov, B., Nasimov, R., Mirzahalilov, S., Sayfullaeva, N., Gadoyboyeva, N. Localization and Classification of Myocardial Infarction Based on Artificial Neural Network. Information Communication Technologies Conference, ICTC2020 p. 245-249.

[19]   I.KhSiddikov., Kh.A. Sattarov.,Kh.E. Khujamatov. Research of the Influence of Nonlinear Primary Magnetization Curves of Magnetic Circuits of Electromagnetic Transducers of the Three-phases Current // Universal Journal of Electrical and Electronic Engineering. Horizon Research Publishing Corporation, USA. 2016, Vol.4(1), pp. 29 – 32. DOI: 10.13189/ujeee.2016.040104

[20]   Afsar Kamal, Khaleel Ahmad, Rosilah Hassan, KhujamatovKhalim. NTRU Algorithm: Nth Degree Truncated Polynomial Ring Units // Functional Encryption (Springer book chapter).

[21]   KhalimKhujamatov, Khaleel Ahmad, ErnazarReypnazarov, DostonKhasanov. Markov Chain Based Modeling Bandwith States of the Wireless Sensor Networks of Monitoring System//International Journal of Advanced Science and Technology, Vol.29, No.4, (2020),pp.4889–4903.

[22]   I.KhSiddikov., Kh.A. Sattarov.,Kh.E. Khujamatov. Modeling and research circuits of intelligent sensors and measurement systems with distributed parameters and values// "Chemical technology control and management" International scientific and technical journal, Tashkent 4-5/2018/ pp. 50-55.

[23]   R. R. Ibraimov and M. O. Sultonova, "Reliability of Open Optical Transmission Systems in the Backbone Core Cellular Networks of Cellular Communication," 2019 International Conference on Information Science and Communications Technologies (ICISCT), Tashkent, Uzbekistan,2019, pp. 1-4, doi: 10.1109/ICISCT47635.2019.9011952.

[24]   Ibraimov, R., &Sultonova, M. (2019). 5G transit connections.Compusoft, 8(5), 3135-3139.

[25]   Matyokubov U.K., Davronbekov D.A. The Impact of Mobile Communication Power Supply Systems on Communication Reliability and Viability and Their Solutions//International Journal of Advanced Science and Technology. Vol.29, No.5, (2020), pp.3374–3385. http://sersc.org/journals/index.php/IJAST/article/view/12023

[26] Davronbekov D.A., Matyokubov U.K. Reliability of the BTS-BSC System with Different Types of Communication Lines Between Them//International Journal of Advanced Trends in Computer Science and Engineering. Vol. 9, No. 4, (2020), pp. 6684 – 6689. http://www.warse.org/IJATCSE/static/pdf/file/ijatcse362942020.pdf   DOI: 10.30534/ijatcse/2020/362942020

AUTHOR'S BIOGRAPHY

Davronbekov Dilmurod Abdujalilovich.
Doctor of Technical Sciences, Associate Professor. Dean of the Faculty of Radio and Mobile Communications, Tashkent University of Information Technologies named after Muhammad al-Khwarizmi. Tashkent, Uzbekistan

Khakimov Zafar Tulyaganovich
Director of the Center for Higher Education Development Research and Introduction of Advanced Technologies, Tashkent, Uzbekistan
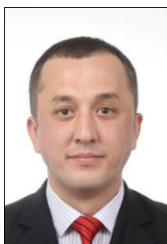
Isroilov Jamshid Dilshodovich
Senior teacher, Researcher in Department of Mobile Communications technologies, Tashkent University of Information Technologies named after Muhammad al-Khwarizmi. Tashkent, Uzbekistan