

# **OPINION**

**on doctoral thesis**

**for acquisition on educational and scientific degree "Doctor of Philosophy" in**

**field on high education – 5. Technical sciences**

**professional field - 5.3. Communication and computer technology**

**doctoral program – Communication networks and systems**

**Author: Eng. Nikolay Petkov Manchev, MSc**

**Topic: Development and research on platform for low energy wireless communications for Internet on the things**

**Member on the scientific Jury: Prof. Eng. Grigor Yordanov Mihaylov, PhD**

## **1. Topic on doctoral thesis**

The problems for the deployment and administration of low-power wireless communications for the Internet of Things are within the scope of specialists working in the field of telecommunications services and their applications.

In this regard, it can be unconditionally assumed that the dissertation deals with contemporary problems related to the development and application of the fundamental theory and practice of communication systems. I accept the justification of relevance made by the doctoral student and consider that the stated considerations are correct and well-founded.

## **2. Methodology on research**

The goal on the thesis is formulated on the foundation on one thorough and reasoned analysis on the contemporary condition on the problems related to deployment and administration on low energy wireless communications for Internet on the things. For the conducted analyzes and research in the actual part of the dissertation, modern mathematical tools are applied, i.e. appropriate methods for analysis and synthesis and modeling of processes in communication networks. The results are presented in tabular and graphic form, with a thorough analysis of the same. Each chapter is accompanied by a summary and conclusions from the main results obtained. In general, in my opinion, a significant amount of research work has been done.

The tasks in the dissertation are adequate to the problem and are solved in the necessary volume and at a high scientific level.

## **3. Contributions on doctoral thesis**

As a result on the study within on dissertation labor are achieved the following scientific-applied and applied Contributions :

### ***Scientific and applied Contributions :***

1. Established are and are investigated proved everything algorithms for encryption on the messages at the use on the low-energy one protocol LoRaWAN , which guarantee security and reliability on transmitted data . Suggested use on the linear method changing everything frequency (Chirp) which contributes for the bigger one security on the data, as by this one way everything uses narrower frequency tape used at the wireless ones communications .

2. An approach is proposed for determination on efficiency on the coverage at the low-energy ones wireless networks in urban environment, based everything on determined indicators divided into three groups - reliability, delay and credibility .

3. An algorithm representing practically approach for realization of RF gateway and sequence at the conduct on the experimental ones indoor and outdoor research zone .

4. The influence is studied on the attitude signal / noise on the quality on the wireless coverage in concrete discovered zone. A comparison has been made assessment between practically received results with simulations in the same zone on radio coverage , such as object on research are the parameters on the ultimate device , the RF gateway , the attenuation in the coaxial line etc.

### ***Practical and applied Contributions :***

1. For the goals on dissertation labor practically realized extremely device on communication system with the use on the low-energy one protocol LoRaWAN for wireless communications with remote control on electric reverse contacts connection on the condition on the contacts .

2. It is practically implemented extremely device with solar power supply that has been tested in period From 3 years at different meteorological conditions . The economy it has been achieved through the newly created software library for optimization on consumption on the ultimate device by time on the non-transmission on data.

3. Proposed and implemented opportunity for VPN connectivity on a few the router with the implemented low energy communication system using LoRaWAN the protocol, with a goal storage on the data on definitely place. In one case drops out the need from the purchase on additional hardware for saving on the data like everything also provide opportunities for processing, analysis, visualization and research on the data from one centralized point.

## **4. Publications and citations on publications by doctoral thesis**

From specified publications I do the conclusion that results in the thesis are approved enough wide on authoritative forums and are estate on the scientific community in the district on communication systems.

## **5. Authorship on received results**

Judging by the publications it's up clearly that the PhD student works hard by this one theme from a few years. For the authorship on contributions on doctoral thesis the fact that one from the publications is independent and in three others the PhD student is second author in the collective. This, as well as the specific style on the author give reasons that I don't have doubt for the leading role on Eng. Nikolay Manchev, MSc in preparation on the publications .

## 6. Opinions, recommendations and remarks to doctoral thesis

The main critical remarks and at the same time recommendations, can be defined as follows:

- It can be recommended the future publications to be oriented to modeling, research, analysis and implementation on the integrated ones informative systems with microservices;
- To publish the results from these research in international magazines indexed in the world databases and conferences with impact factor .

These critical remarks do not diminish the value of the dissertation.

## 7. Conclusion

I believe that the presented doctoral thesis **answers** on the requirements on the Law for development on the academic composition in Republic of Bulgaria. Achieved results give me reason **to suggest** to be acquired educational and scientific doctor degree to Eng. Nikolay Petkov Manchev, MSc in field on high education - 5. Technical sciences, professional field - 5.3. Communication and computer technology, doctoral program - Communication networks and systems

31.01.2024

**Signature:** /signature/  
/Prof. Eng. Gr. Mihaylov, PhD/