The pH value is considered as a key parameter, giving information about general conditions of the environment in many fields, including agriculture, medicine, environment protection, metallurgy. Moreover, it enables the detailed controlling and monitoring of the chemical reactions, metabolic and industrial processes, being crucial from the engineering and biological point of view. The accurate detection of pH value has a huge importance in medical terms, where even small pH changes can point to the presence of serious inflammations and diseases, such as cancer and Alzheimer. Taking into account the wide range of pH applicability and its significance, the investigations concerning the improvement of the accuracy and credibility of pH detection must be implemented. Based on this, the aim of the research project embraces the synthesis and development of novel luminescent pH-indicators, meeting all given requirements and providing contactless and fast measurement of the local conditions, simultaneously being able to be used for various environments. The pH-sensing capabilities of analyzed indicators based on the response of luminescence of vanadium ions, namely V^{5+}, V^{4+} and V^{3+}, on the pH fluctuations, ranging from acidic to basic reaction. These ions, being embedded in the garnet crystal structure, reveal interesting optical properties, which are strongly affected by environment changes. Furthermore, the vanadium ions are located in the different parts of the inorganic lattices, namely V^{5+} ones occupy the surface of the material, whereas the V^{4+} and V^{3+} ions are localized inside the crystal. Due to this phenomenon, vanadium ions can easily interact with the surrounding, which is evident in the changes of their luminescent intensity and thus the emission colour. The detailed research tasks will be focused on the creation of the V-based pH-sensors, characterized by the thermal-stability, wide operating range, small size (10^{-9} m) and high sensitivity, which definitely surpass the commonly used approaches, whereby the presented pH-sensors can be considered as promising substitutes for conventional pH-meters. The analysis of the morphology and the structure of obtained luminescent nanomaterials will be provided, which in turn enables the verification of the synthesis method efficiency and the implementation of synthesis modification. The susceptibility of vanadium ions emission to pH changes will be investigated using detailed spectroscopic measurements, which allow fast detection and presentation of their luminescent intensity. The emphasis will be put on the examining of the reproducibility of pH-sensing using vanadium-based indicator. To provide more accurate pH-detection the vanadium emission intensity will be compared with the luminescence of neodymium ions (Nd^{3+}), which reveal definitely less environmental influenced optical properties. The presented luminescent pH-indicators enable the detection of environment reaction in uncomplicated manner, where the size in nano-scale shows their potential to be applied in many filed, essentially in biomedicine applications. Based on the current state of knowledge, concerning the possibility to pH-sensing, we believe that presented research project has an innovative character.