Efficient use of energy resources is one of the most important challenges regarding work on data transmission algorithms for wireless sensor networks. The sensor networks considered in the thesis are built with nodes that selectively transmit sensor readings to a base station. Selective transmission means that the sensor node sends the currently recorded data only in selected cases, such as when the data indicates a significant change in the parameters of the monitored environment. Due to master node tasks, it consumes its energy faster than the slave node. Therefore, to achieve an extended network lifetime, the master node role must be periodically transferred between nodes belonging to the cluster.

The main objective of the thesis is to propose algorithms for selecting a master node in a network cluster, which will enable better use of available energy and increase the lifetime of wireless sensor networks compared to other available methods. Currently, available algorithms for selecting and changing the master node in a sensor network cluster do not allow fully efficient use of energy resources when nodes transmit data selectively, i.e. only in selected steps of network operation. The thesis attempts to develop algorithms that consider the abovementioned requirements, adopting two definitions of lifetime, i.e. time to discharge one node and time to discharge all nodes in the network.

The realization of the objective stated above included the following stages:

- **Conducting a comparative analysis** related to the topic of this thesis on existing methods for extending the life of sensor networks and algorithms for selecting a master node in a cluster.
- **Development of own master node selection algorithms** that consider the probabilities of data transmission from individual nodes.
- **Preparing the research environment** physical model of the sensor network and implementation of the developed algorithms and representative algorithms available in the literature. The physical model has been developed in two versions that differ in the data transmission technology used (ZigBee and LoRaWAN).
- **Conducting experiments using the physical network model**, which include measuring the energy consumption and lifetime of sensor nodes for the compared algorithms.
- **Development and implementation of a computational model** that represents the physical model of the sensor network and calibration of the computational model based on the results of experiments conducted on the physical model.
- **Conducting experiments using a computational model** for many varied scenarios considering constant and variable probabilities of data transmission from individual sensor nodes. Tests on the lifetime of the wireless sensor network for the compared master node selection algorithms were performed.

The proposed method considers different levels of battery charge in sensor nodes and time-varying transmission probabilities, effectively extending the life of the sensor network.

The experiments included comparing the proposed methods for changing the role of the master node with currently used algorithms that consider the time of the master role and energy consumption. Based on the experiments, it was shown that for algorithms in which the role of the master node is transferred after a specific time, energy is used in a suboptimal way. Based on the experiments, it was shown that using the proposed method, the lifetime of the prototype sensor network is significantly increased compared to other algorithms known from the literature. The result of the completed work also includes proposals for further research directions on data transmission algorithms in wireless sensor networks. The proposed methods can be further developed and improved by, among other things, introducing appropriate algorithms for predicting transmission probabilities from individual nodes and mechanisms for handling a more complex hierarchy of nodes, considering nodes equipped with different sets of sensors.