ABSTRACT

Indonesia faces worsening traffic congestion problems due to rapid population growth and urbanization. High population density puts pressure on road infrastructure and disrupts traffic flow. Traffic lights play an important role in regulating the flow of vehicles, but are often ineffective in giving priority to ambulances, especially when red light coordination is inadequate. According to Article 134 of the Road Traffic and Transportation Law, ambulances and other emergency vehicles should get priority, but lack of driver awareness and communication limitations make the implementation of this rule not optimal. This research aims to design a Radio Frequency (RF) based system that can automatically change traffic light cycles to give priority to emergency vehicles such as ambulances, in order to improve emergency response and reduce the impact of traffic congestion.

The proposed solution to this problem is to use Radio Frequency (RF) technology, where there will be a device in the ambulance vehicle that will provide signal input sent to the traffic light control center wirelessly using 2,4 Hz Radio Frequency. The application of an ambulance detection system using RF signals with nRF24L01+ can be used to identify incoming ambulance vehicles. Each ambulance vehicle that has been fitted with a TX antenna in the form of nRF24L01+ can send a signal to the RX antenna located at the traffic light. When the system is connected, the CORE can process the signal received by the RX antenna to interrupt the traffic light scheme from a normal scheme to an emergency scheme.

The ambulance device has a total current of only 22,1 mA under normal conditions and 43,9 mA under emergency conditions. The power used by the device is efficient to support the operational needs of ambulance vehicles. The detection distance of the nRF24L01+ antenna has the farthest detection distance radius of 16 meters without obstacles and 14 meters with obstacles. While the detection distance of the nRF24L01+ PA LNA antenna has the farthest detection distance radius without obstacles of 75 meters and 60 meters with obstacles. This shows that the detection distance radius is far enough to support the operational needs of ambulance vehicles.

Keywords : Ambulance, Traffic Light, nRF24L01+, Radio Frequency, Arduino .