Capitol Graduate Research Summit

BLOOD GLUCOSE REGULATION USING TYPE 1 FUZZY CONTROLLER

Priyanka Thakur[1], Yrithu Pillay[2], Dr. John Watkins[3] and Dr. Edwin Sawan[4]
[1,2,3] Department of Electrical and Computer Engineering, Wichita State University, [4] School of Computing, Wichita State University

Maintaining blood glucose levels (BGL) within a safe range is vital for optimal health, directly affecting energy production and cellular function. Stable levels support cognitive function, and sustained energy, as well as prevent cardiovascular and neurological issues. Understanding blood glucose control is important, especially for diabetic patients who cannot naturally maintain stable glucose levels to stay healthy. In Kansas, where diabetes ranks as the 7th leading cause of death and approximately 1 in 9 adults have the condition, along with 11.7% diagnosed with prediabetes, blood glucose regulation is paramount. This study focuses on regulating blood glucose levels and maintaining it in the safe range of 70 to 180 mg/dL, using a closed-loop control strategy with a Mamdani Type-1 fuzzy logic controller. The effectiveness of the proposed controller was tested for three test scenarios. The first test case investigated the performance of the controller on a severe case of a hyperglycemic Type-1 diabetic patient (BGL > 180 mg/dL). The second test case examined how well the controller performed on a diabetic patient with normal blood glucose levels while being subjected to a very high meal disturbance i.e., a high carbohydrate meal. The third test case explored the functioning of the controller where a Type-1 diabetic patient experiencing hyperglycemia (BGL > 180 mg/dL) is subjected to a heightened meal disturbance. The simulation results demonstrated consistent effectiveness across all scenarios. The simulated results are presented and discussed.