

**CLOSED LOOP CONTROL OF BLOOD GLUCOSE
LEVEL THROUGH SIMULTANEOUS ESTIMATION OF
BLOOD INSULIN AND GLUCOSE**

MS Thesis report submitted to
Indian Institute of Technology Mandi
in partial fulfilment for the award of the degree of
MS(By Research)
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Electrical Engineering

by
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Under the supervision of
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September 15, 2019

Declaration by the Research Scholar

This is certify that the Thesis entitled "CLOSED LOOP CONTROL OF BLOOD GLUCOSE LEVEL THROUGH SIMULTANEOUS ESTIMATION OF BLOOD INSULIN AND GLUCOSE", submitted by me to the Indian Institute of Technology Mandi for the award of the Degree of Master of Science (by research) is a bonafide record of research work carried out by me under the supervision of Dr. Shubhajit Roy Chowdhury. The content of this Thesis, in full or in parts, have not been submitted to any other Institute or University for the award of any Degree or Diploma.

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Declaration by the Research Advisor

This is certify that the Thesis entitled "CLOSED LOOP CONTROL OF BLOOD GLUCOSE LEVEL THROUGH SIMULTANEOUS ESTIMATION OF BLOOD INSULIN AND GLUCOSE", submitted by Mr. Bodhayan Nandi to the Indian Institute of Technology Mandi for the award of the Degree of Master of Science (by research) is a bonafide record of research work carried out by him under my supervision. The content of this Thesis, in full or in parts, have not been submitted to any other Institute or University for the award of any Degree or Diploma.

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Abstract

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Type 1 diabetes is an important health problem in the world, that affects adults, adolescents and even very young children. Type 1 diabetes is identified as an autoimmune disease. It causes unreparable destruction of the pancreatic beta cells as a result, Insulin production ranges from negligible to nil. Insulin is the hormone which regulates the blood glucose level. Since the pancreas is no longer able to produce insulin, the subject can experience chronic hyperglycaemia.

The current work is focused on achieving a closed loop control of the patient's blood glucose by measuring the blood insulin and glucose levels. For this a continuous insulin and glucose monitoring system has been implemented that keep track of patient's insulin and glucose levels. An artificial pancreas system has been implemented that controls the blood

glucose level through a calculated amount of insulin infusion in the lower abdominal region through a cannula.

In this thesis work, the modification in the available closed loop control algorithm for blood glucose is discussed. Continuous Glucose Monitoring device and Continuous Insulin monitoring device is discussed. The device employs Photoplethysmography (PPG) to predict the blood parameters. The PPG waveforms are processed to find the correlation of concentration of blood analytes with changes in the features of the PPG signal. Finally, the thesis focuses on how simultaneous estimation of blood insulin and glucose level leads to proper control of blood glucose level.

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