
UNIVERSITI PUTRA MALAYSIA

# DEVELOPMENT OF INTERNET- BASED INSTRUMENTATION SYSTEM FOR STUDY OF THE HALL EFFECT.

ARIFFIN BIN ABAS

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# DEVELOPMENT OF INTERNET- BASED INSTRUMENTATION SYSTEM FOR STUDY OF THE HALL EFFECT.

**By**

**ARIFFIN BIN ABAS**

**Thesis Submitted to the school of Graduate Studies, Universiti Putra Malaysia, in Fulfillment of the Requirements for the Degree of Doctor of Philosophy.**

**December 2011**

## DEDICATION

The author wish to dedicate this thesis report to his parents,

Especially his wife,  Noor faizah

Children, yeeyee, kak mok, kak cik, fartihah, apis

And

His Fellow Course mates and

Friends

Who had been his source of flames of inspiration and perspiration.

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the Degree of Doctor of Philosophy.

**DEVELOPMENT OF INTERNET- BASED INSTRUMENTATION SYSTEM FOR STUDY OF THE HALL EFFECT.**

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**December 2011**

**Chairman: Professor Abdul Halim Shaari, PhD**

**Faculty: Science**

The computer together with Lab View software can be used as automatic data acquisition system. This project deals with the development of a computer interfacing technique (automation system) for the study of Hall effect and converting the existing automation system into web based automation system. The drive board RS 217-3611 with PCI 6025E card and stepper motor RS191-8340 with resolution of 0.1mm was used to move a pair of permanent magnet backward and forward against the sample. The General Interface Bus (GPIB) card interfaces together with digital nano voltmeter/Current source and Tesla meter using serial port RS232 interface are used to measure potential difference/current supply and magnetic field strength respectively. These systems (hardware interfacing) were able to log, store and plot the graph of Hall voltage as a function of magnetic field strength which can be viewed at the front panel display of the Lab View programming. Hall effect measurement at room temperature on Copper (Cu) and Tantalum (Ta) showed negative and positive sign Hall coefficient indicating that the systems have electron or hole charge carriers respectively. These phenomena can be explained using Free Electron Model (FEM) and Energy Band

Theory (EBT). The Hall effect for $YBa_2Cu_{3-x}Ti_xO_{7-\delta}$ system (where by x=0.00, x=0.01, x=0.03 and x=0.05) was found to show positive sign Hall coefficient making this system a predominantly hole carrier at room temperature.

The parameters such as Hall coefficient, drift velocity, conductivity, mobility, and charge carrier concentration were also automatically displayed on the front panel of Lab View programming and compared with previous value by other researchers and Lakeshore Hall effect measurement system model 7604.

The Web based automation system can be remotely controlled and monitored by users in another location by using only their web browsers. This is achieved by programming the server computer to load Java Applets containing the users interface required to control the automation system into the remote user's web browser and data can be remotely acquired through File Transfer Protocol (FTP). In addition, video conferencing through Net Meeting program has been used to provide audio and video feedback, with web camera mounted on moveable platform so that the user can control viewing angle. The obvious advantage of this system is in the field of education. Student can viewing and control physics experiments carried out live over internet and also participate over conventional Web browsers in real time. In this project, the apparatus that has been developed to measure the Hall effect at room temperature is simple, cheaper, mobile, easy to handle and able to give accurate result as compared to the previous researcher. This system which has not been developed previously can now be developed as an affective teaching aid.

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Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah.

**PEMBANGUNAN SISTEM INSTRUMENTASI BERDASARKAN INTERNET UNTUK MENGKAJI KESAN HALL.**

Oleh

**ARIFFIN BIN ABAS**

**Disember 2011**

**Pengerusi: Profesor Abdul Halim Shaari, PhD**

**Fakulti: Sains**

Sebuah komputer bersama program software LABVIEW boleh digunakan untuk sistem pengambilan data secara automatik. Projek ini berkaitan dengan pembangunan teknik antaramuka ( sistem automasi) untuk mengkaji kesan Hall dan menukarkannya sistem automasi yang sedia wujud kepada sistem automasi berdasarkan internet.Pemancu papan RS 217-3611 dengan kad PCI 6025E dan sebuah motor pelangkah RS191-8340 dengan resolusi 0.1mm yang digunakan untuk menggerakkan sepasang magnet kekal ke hadapan dan belakang terhadap bahan ujian. Kad antaramuka umum bersama dengan nano voltmeter/Sumber arus dan meter Tesla menggunakan liang RS232 digunakan untuk mengukur beza keupayaan/sumber arus dan kekuatan medan magnet masing-masing. Sistem ini (Antaramuka pekakasan) berkeupayaan untuk log,menyimpan dan melukis graf beza keupayaan Hall sebagai fungsi kekuatan medan magnet yang mana boleh diperlihatkan daripada paparan panel hadapan program lab view. Pengukuran kesan Hall pada suhu bilik keatas Kuprum dan Tantalum menunjukkan tanda negatif dan positif pekali Hall menunjukkan bahawa pembawa cas mempunyai tanda negatif dan positif masing-masing. Fenomena ini boleh diterangkan menggunakan Model Elekron

Bebas dan Teori Jalur Tenaga. Kesan Hall untuk sistem $YBa_2Cu_{3-x}Ti_xO_{7-\delta}$ (dimana x=0.00, x=0.01, x=0.03 and x=0.05) juga didapati menunjukkan pekali Hall tanda positif menjadikan sistem ini di dominasi oleh lohong pada suhu bilik.

Parameter seperti halaju hanyut, kekonduksian, kelincahan hall, pekali Hall dan ketumpatan pembawa cas juga dipaparkan secara automatik pada panel hadapan program Lab view dan di bandingkan dengan nilai piawai dari penyelidik terdahulu dan sistem pengukuran kesan Hall Lakeshore model 7604.

Sistem Automasi berdasarkan internet boleh dikawal dan diselia oleh pengguna di tempat kawalan lain dengan hanya menggunakan pelayar web. Ini boleh dicapai dengan memprogramkan komputer server untuk memuat turun Java Applet yang mengandungi pengguna antaramuka yang diperlukan untuk mengawal sistem automasi kepada web browser kawalan pengguna dan kawalan pengambilan data boleh diperolehi melalui Protokol perpindahan file (FTP). Sebagai tambahan persidangan video melalui program Net Meeting telah digunakan untuk membekalkan audio dan video dengan web kamera diletakkan pada platform boleh ubah supaya pengguna boleh mengawal paparan dari berbagai sudut. Adalah jelas kelebihan sistem ini adalah dalam bidang pendidikan. Pelajar boleh diperlihat dan mengawal eksperimen fizik secara langsung melalui internet dan boleh menyertai melalui pelayar web konversional dalam masa nyata. Dalam projek ini, peralatan yang telah dibangunkan untuk mengukur kesan Hall pada suhu bilik adalah mudah, murah, mudah alih, senang untuk dikendalikan dan memberikan keputusan yang jitu seperti dibandingkan dengan penyelidik yang terdahulu. Sistem ini yang mana belum dibangunkan sebelum in boleh dibangunkan sekarang sebagai alat bantu mengajar yang berkesan.

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Credit is also given to anyone who had either directly or indirectly contributed to the completion of this thesis and also this research project.

I certify that a Thesis Examination Committee has met on 22 December 2011 to conduct the final examination of Ariffin bin Abas on his thesis entitled " Development of Internet-Based Instrumentation System for Study of the Hall Effect" in accordance with the Universities and University College Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106**]** 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

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## DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.

**ARIFFIN BIN ABAS**

Date: 22 December 2011

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