DESIGN AND DEVELOPMENT OF INTELLIGENT HOME AUTOMATION SYSTEM (IHAS) FOR ENHANCED ENERGY PERFORMANCE

Basnayake Appuhamilage Don Janaka Chaminda Kumara Basnayake

158055G

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Department of Mechanical Engineering

University of Moratuwa

Sri Lanka

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The above candidates have carried out research for the Masters thesis under my supervision.

Name of the supervisors: Prof. R.A. Attalage

Dr. Y.W.R. Amarasinghe

Dr. A.G.B.P. Jayasekara

Signature of the supervisors: Date

Signature of the supervisors: Date

Signature of the supervisors: Date

ABSTRACT

With the growing distresses on carbon emission and sustainable energy concepts, the whole world appreciates the movements towards sustainable energy consumption. Statistics point out that over 50% of total electricity generation is consumed by three sectors, namely residential, commercial and public services. Among them, the residential sector alone consumes over 25% of total energy consumption which can possibly be attributed to heating, ventilation, air-conditioning (HVAC) and lighting used for occupants' comfort. However, over 65% of global electricity generation is based on fossil fuel and natural gases, residential electricity consumption is accountable for a substantial extent of global carbon emission, consequently the present climate calamity.

Researchers across the globe have figured out that the theories on sustainable energy consumption should start with our own home. It is required to focus on reducing the energy consumption by home HVAC systems, lighting systems and other appliances while keeping residential comfort level untouched. Home automation systems have shown their success towards the goal amidst several drawbacks.

This research, proposes an intelligent home automation system (IHAS) with a real-time sensor network. The system has the ability to perform user preference based automation on the premises based on user comfort, safety and energy efficiency. The proposed system consists of a wireless sensor network, intelligent controller and device control interface. The sensory system monitors the environment and the identified information transferred to the intelligent central controller, which makes the accurate decision on most efficient configurations for the home appliances. It includes HVAC system, lighting systems and multimedia systems thus optimizing power consumption and improving user comfort. Finally, the device control interface delivers the obtained control decisions to the appliances through the default control interface.

The developed non-interactive user identification system will recognize individual users within the premises and track their activities to obtained individual user preferences related to the comfort and multimedia devices. Based on those preferences and real-time ambient conditions measured through climatic sensor systems, the central controller will decide the configurations for the home appliances.

The entire work includes the design and fabrication of different hardware systems and firmware implementations based on 8-bit and 16-bit microcontrollers. The central controller was developed on a single board computer which is powered by 32 Bit ARM Cortex A11 CPU. Fuzzy inference systems were used to implement the intelligent control algorithms of different control application of the proposed system.

Key Words: Home Automation, Intelligent Control, Sensor Systems, Mechatronics

DEDICATION

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Mr. B.A.D.J.C.K. Basnayake,

M.Sc. Postgraduate,

Department of Mechanical Engineering,

University of Moratuwa.

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