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DESIGN OF ELECTRIC KETTLE USING DFA

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***Abstract* - An electric kettle is an electrical appliance, that has a self-contained heating unit, for heating water, and automatically switches off when the water reaches boiling point or at a preset temperature below 100 °C. Its energy efficient and faster compared conventional heating techniques. We propose a design for electric kettle using Deterministic Finite State Automata.**

Index Terms ***–Electric Kettle, Deterministic Finite State Automata.***

I. INTRODUCTION

In countries with 200–240 V mains electricity, electric kettles are commonly used to boil water without the necessity of a stove top. The Slovick, or heating element, is typically fully enclosed, with a power rating of 2–3 kW. This means that the current draw for an electric kettle is up to 13 A, which is a sizeable proportion of the current available for many homes: the main fuse of most homes varies between 20 and 100 amps. In countries with 120 V mains electricity twice as much current is drawn for the same power. In some of those countries electric kettles, while available, are less popular since most electric sockets are current limited to providing around 1.5 kW and kettles heat much more slowly.

Electric kettles were introduced as an alternative to stovetop kettles in the latter part of the 19th century. In 1893 the Crompton and Co firm in the United Kingdom started featuring electric kettles in their catalogue. However, these first electric kettles were quite primitive as the heating element couldn't be immersed in the water. Instead, a separate compartment underneath the water storage area in the kettle was used to house the electric heating element. The design was inefficient even relative to the conventional stove-top kettles of the time.

There are two primary advantages to an electric kettle: it heats water faster and more efficiently than a kettle on the stove and it has an automatic shut-off valve when the water has come to a boil. Anyone who has accidentally forgotten a kettle on the stove will appreciate this benefit.

In DFA, for each input symbol, one can determine the state to which the machine will move. Hence, it is called Deterministic Automaton. As it has a finite number of states, the machine is called Deterministic Finite Machine or Deterministic Finite Automaton.

II. LITERATURE SURVEY

Two important types of finite automata are typically distinguished: Deterministic Finite Automata (DFA) and Non-Deterministic Finite Automata (NFA). While both types provideequal expressiveness, DFAs differ substantially fromNFAs in the way they process data. An essential propertyof DFAs is that at any given point in time only one stateis active, i.e., for each input symbol a single state needs tobe processed. DFAsare usually larger than NFAs which can be seen, for example, in the automaton for the expression(0|1)* 1 $(0|1)^i$ (?)where $(0|1)^i$ denotes an i-fold repetition of subexpression(0|1). Whereas a non-deterministic automaton for this expressioncan be built with 1 +(i+1) states, a correspondingDFA requires at least 1 + $(2^{i+1} - 1)$ states. In general, aDFA may require up to 2n states compared to an equivalentNFA with only n states [13]. The consequences of thisphenomenon, known as state explosion, can be exceptionally severe for implementations in hardware where resources are more scarce.

IV. PROPOSED DESIGN

In this DFA,there are three states Electric Switch,Kettle Switch and Boiledwater. If Electric Switch is ON it will check

for Kettle Switch. If Kettle Switch is ON, water starts to boil until it reaches 100 degree Celsius. Once it reaches 100 degree Celsius , Kettle is OFF.

Below is Deterministic Finite State automata of Electric Kettle.

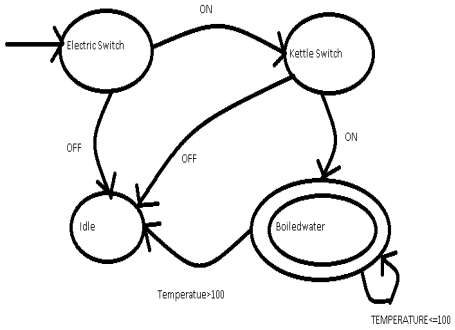

Fig.1: State Diagram of Electric Kettle

Electric Kettle is designed using verilog . Its simulated in cadence virtuoso.

Verilog code-

```
module Electric_Kettle(input
electric_switch_on,electric_switch_off,kettle_on,kettle_of
f,output boiledwater);
reg boiledwater;
wire temp=0;
reg idle;

always@(electric_switch_on or electric_switch_off or
kettle_on or kettle_off)
if(electric_switch_on==1'b1)
begin

if(kettle_on==1'b1)
begin


if(temp <= 100)
begin

boiledwater <= 1'b0;

idle <= 1'b0;

end
else
begin
boiledwater <=1 'b1;
idle <= 1'b1;
end

end

else
idle <= 1'b1;
end

else
idle <= 1'b1;
endmodule
```

V. RESULTS

The suggested architecture is designed using Verilog Hardware Description Language (HDL). The behavioral description has been written for this design and Cadence Virtuoso is used for simulation of the model. The functionality of the design has been tested and verified.

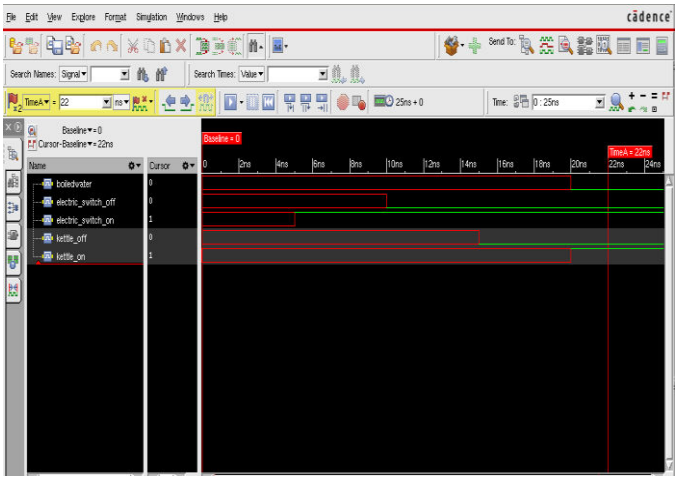

Fig.5: Simulation Results

VI. CONCLUSION

The Electric Kettle is designed using Deterministic Finite Automata. The design is done using Verilog Hardware Descriptive Language.The design is simulated using cadence virtuoso and functionality is verified.

REFERENCES

[1] A. BabuKaruppiah, S. Rajaram,"Deterministic Finite Automata for pattern matching in FPGA for intrusion detection",May,2011,IEEE Conference.

[2] B. L. Hutchings, R. Franklin and D. Carver, "Assisting network intrusion detection with reconfigurable hardware", Proceedings of the IEEE Symposium on Field-Programmable Custom Computing Machines*, pp.*

[3] Zachary K. Baker and Viktor K. Prasanna, "A methodology for synthesis of efficient intrusion detection systems on FPGAs*",* IEEE Symposium on Field-Programmable Custom Computing Machines (FCCM)*, Apr. 2004.*

[4] K Inoue, I Takanami, A Nakamura. A note on two-dimensional finite automata [J]. Information Sciences, 1982, 26 (1): 65-85..

[5] M Blum, C Hewitt. Automata on a two-dimensional tape [C]. IEEE Symp. on Switching and Automata Theory, 1967, 155-160.

[6] S. Almagor and O. Kupferman. Max and sum semantics for alternating weighted automata. In atva11, springer, 2011.

[7] F. Bergadano and S. Varricchio. Learning behaviors of automata from multiplicity and equivalence queries. SIAM J. Comp, 25, 1996.