# CHAPTER-7

# CONCLUSION

The current research work is mainly focused on five objectives mentioned in chapter-1. The first objective was to design a system to observe performance of home appliances, which is achieved in term of an intelligent hybrid remote control, which is capable of sensing and displaying the environment parameter (temperature, humidity and light intensity) values on LCD. The performance analysis is discussed in chapter-6, in terms of power consumption analysis of heating system, lightning system and humidity control system which is observed by using Heater, Bulb and Exhaust Fan respectively.

The second objective was to implement a generic optimization algorithm to control the dimming levels of appliances, which is achieved by developing an algorithm termed as PSO-PID and the performance by this algorithm is compared with other algorithms termed as PID and GA-PID. The results discussed in the chapter-6 clearly declared PSO-PID as better algorithm over other mentioned algorithms.

The third objective was the performance analysis of the system by simulation of the designed system, which is achieved by finding the transfer functions and then implementing it with the simulation model by using MATLAB Simulink. Transfer functions, step responses and transient responses of the appliances and programming steps involved are discussed in chapter-4, 5 and 6.

The fourth objective was to design a hybrid RF remote control, which is the major outcome of the current research and achieved by developing a single remote control for controlling the dimming levels of three home appliances (Heater, Bulb and Exhaust fan), in two modes called semiautonomous mode and autonomous mode.

The fifth objective was hardware implementation of the system, which is successfully developed and snapshots are displayed in this chapter.

All the five objectives are achieved successfully and seven research publications are published during the research duration, which are discussed in this chapter to support the validity and novelty of the research work.

## 7.1 Major Outcomes of Research

The major outcomes of the research are concluded as follows-

- A Smart remote control with a generic optimization algorithm is designed.
- A new approach in terms of optimization of dimming level of appliances is introduced to utilize energy more efficiently.
- Experimental data for heater for two hours in room size of 10*8*10 using PSO-PID to maintain room temperature at $30^0$C with initial temperature $29^0$C shows 14.88% power saving.
- Experimental data for exhaust fan for four hours in room size of 10*8*10 using PSO-PID to maintain room humidity at 42% with initial humidity 44% shows 36.9 % power saving.
- Experimental data for bulb for four hours in room size of 10*8*10 using PSO-PID to maintain room light intensity at 80% shows 37.49% power saving.

## 7.2 Snapshots of the Developed System

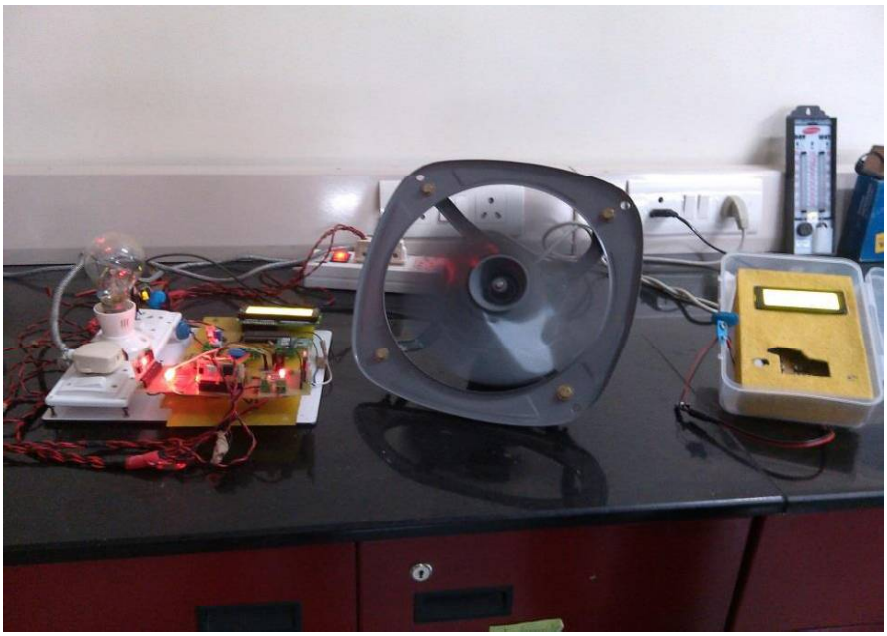

Fig.7.1 (a) Snapshot for developed system


Fig.7.1 (b) Snapshots for developed receiver and remote control

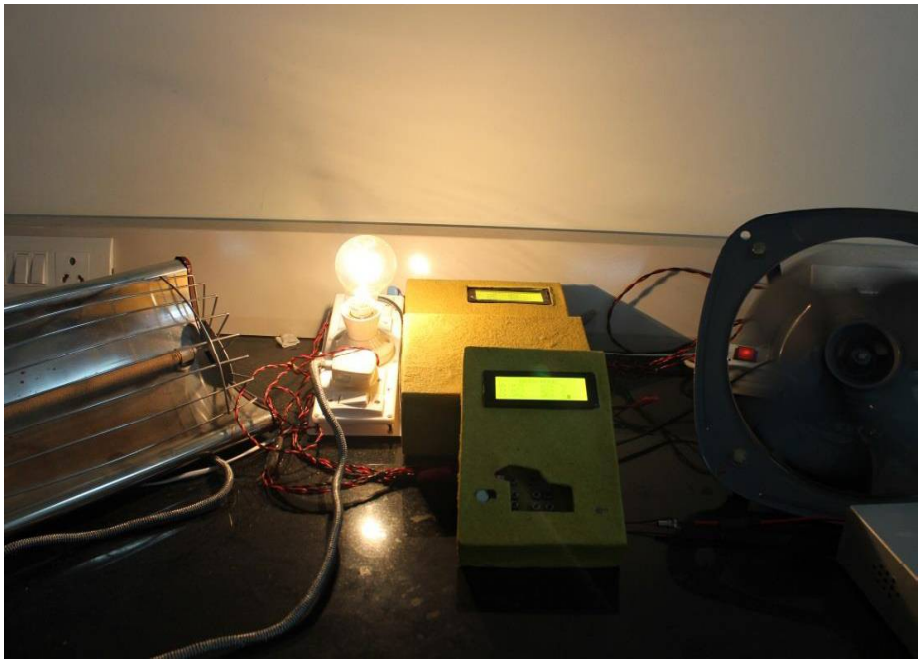

Fig.7.1 (c) Snapshots for developed receiver and remote control

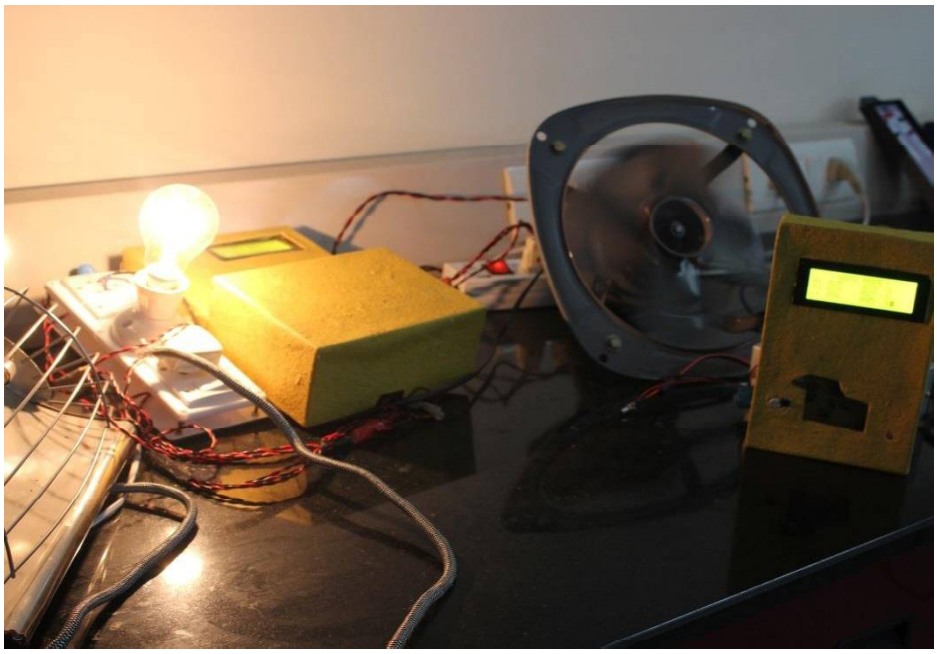

Fig.7.1 (d) Snapshots for developed receiver and remote control

### 7.3 Discussion and Future Scope

The primary focus of the developed system is to solve the problem of energy wastage due to human laziness and lethargy. The literature survey suggests that although PID has been used for system parameter control, but by experimental data analysis it is concluded that PSO-PID is better optimization algorithm than PID and GA-PID. This dissertation suggests implementation of PSO-PID for the purpose of dimming the home appliances in order to save power. The system is equipped with the mechanism to control the intensity of light, temperature and humidity of room, by the use of error signal generated from the difference of feedback from sensors (which is connected with remote control) and input value by user through key pad available on remote control. It has been demonstrated with experimental data in 10*8*10 cubic feet room size, the results shows a considerable amount of power saving. It is observed that current consumption by remote control is 99.5mA and by receiver section it is 154mA. Results shows power saving of 14.88% for 1KW heater, 37.49% for 100W bulb and 37.49% for 18W exhaust fan w.r.t conventional appliances. It is also

concluded that the code size for remote control is 3.85KB and for receiver section it is 3.53KB, which is lesser than existing mica mote.

The system is user friendly, safe and ease to use. The system can be used in big apartments, shopping mall, waiting rooms in railway station etc.

In the future more number of appliances can be interfaced for dimming of more number of appliances like CFL, florescent lamp and LED bulb. Since the system is modular, more number of modules can easily be interfaced in order to upgrade the system. The number of dimming levels in current system is taken as 16levels, which can be increased upto 256 levels for more efficient dimming.

The novelty of the hardware system is actual implementation of PSO-PID algorithm to maintain ambient conditions of room. An intelligent hybrid remote control is developed for three appliances.

Novelty of the software system is that a new packet format has been developed with unique ID for RF module (Zigbee), which is used for communication between remote control and receiver section.