Design of Embedded System for Controlling Condensation System of the car

Lee Dmitriy, Nam Hyo-Duk, Seo Hee-Don

Department of Electronic Engineering, Yeungnam University, 214-1 Dae-dong, Gyeongsan, Gyeongbuk, South Korea, 712-749 Phone: (82)-53- 810-2553
Email: dmitriy2008@yahoo.com, hdseo@yumail.ac.kr

ABSTRACT

Road traffic accidents kill more than one million people a year. ESCC represents a new device, that hasn't any analogue. This embedded system, heats the car glasses, when it's needed, that makes more safety driving. It's build on Atmega128L CPU, using high-performance EEPROM CPLD ATF1504AS. Source code was written in C language. Algorithm of work was written by dew-point table. This system is not only clearing the glass from condensation, but averts condensation. ESCC began working, when input information became close to dew-point table information. Thankful this device, field of view is more widely, that increase safety level.

1. Introduction

Road traffic accidents kill more than one million people a year, injuring other thirty-eight million (5 million of them seriously). The death toll on the world's roadways makes driving the number one cause of death and injury for young people ages 15 to 44.

How safe is that new or used vehicle you're thinking of purchasing? With the introduction of airbags and crash-testing, the number of people killed and injured by motor vehicles has decreased in many countries.

Condensation is a very common phenomenon in everyday life. Although it doesn't leave durable signs on window panels, it can be very unpleasant because it reduces visibility. When water vapour from the air comes into contact with cold surfaces, the vapour condenses on the cooler surface of the glass forming a foggy effect. While this condensation is annoying, it also indicates excessive humidity inside the car.

People usually are lazy to clean glasses at the morning, and consequently lots of automobile accidents. Driver keeps in danger not only himself, but other people too.

Nowadays, modern cars have heater of rear glass, and electronic powerful heating system of passenger compartment.

Automatic Climate Control

The technology of keeping drivers comfortable continues to evolve with each new model year. When automotive air conditioning was offered as a high-priced option back in the 1950s (actually the 1939 Packard was the first car to have factory air), no one would have guessed that half a century later more than 80 percent of the cars and light trucks in North America would be equipped with A/C - or that an estimated 20 to 25 million automotive A/C systems are serviced annually in this country.

Many new cars and trucks now have automatic temperature control (ATC) systems that not only regulate cooling but also heating for year-round passenger comfort. Most of these systems have their own computer that may be built into the control panel head, located elsewhere or integrated into the body control module. One thing's for sure: The more sophisticated the system is, the more complex are its control electronics and operating logic - which increases the odds of something going wrong.

Air Conditioning Cooling Problems

All this technology is great when it works the way it is designed, but sometimes things go wrong. One of the biggest problems auto makers face today is that many motorists don't fully understand their ATC systems. They may not understand which buttons do what or why. And very few grasp the control logic their ATC system uses to regulate itself and what happens when.

When a vehicle is first started, the system logic may prevent it from blowing hot or cold air until the engine has run a certain length of time or reached a certain operating temperature. The operating logic will choose which ducts the hot or cold air blows out of as well as the fan speed and the position of the recirc door. Most ATC systems have a manual override mode or semi-automatic mode that allows the driver to control more of its functions, but even some manual control modes must pass through the computer and be acceptable to the operating logic.

Every auto manufacturer develops its own operating logic - and that may vary from one model to another and from one year to the next. The logic may dictate that the system go into the recirc mode to maximize cooling when a vehicle is first started on a hot day, or it may not. Most systems will not turn the A/C compressor on if ambient temperatures are below freezing. Most will run the A/C compressor when the system is in the defrost mode to dehumidify the air.

Temperature and dew-point

Temperature is a measure of hotness or coldness. On a daily basis, temperature is one of the most widely monitored and disseminated weather parameters obtained from the surface observation.

a. Temperature. The degree of hotness or coldness of the ambient air as measured by any suitable instrument.

b. Dew point. The temperature to which a given parcel of air must be cooled at constant pressure

and constant water-vapor content in order for saturation to occur.

c. Maximum temperature. The highest temperature recorded/measured during a specified time period.

2. Safety and ECU

The answer is that safety glass is used in automobiles. Safety glass is something many of us look through every time we ride inside a vehicle or enter a public building. There are two kinds of safety glass:

Laminated

Tempered

Automakers began using laminated safety glass, also known as auto glass, for automobile windshields in 1927. To make laminated safety glass, the manufacturer sandwiches a thin layer of flexible clear plastic film called polyvinyl butyral (PVB) between two or more pieces of glass. The plastic film holds the glass in place when the glass breaks, helping to lessen injuries from flying glass. The film also can stretch, yet the glass still sticks to it. It is also quite difficult to penetrate laminated safety glass, compared to normal window pane glass. The "sandwich with some give" that laminated safety glass is made of also helps hold the occupants in a vehicle! Banks use a multiple-layer laminated glass to help stop bullets.

In automotive electronics, an electronic control unit (ECU), also called a control unit or control module, is an embedded system that controls one or more of the electrical subsystems in a vehicle. Some modern cars have up to 70 ECUs, including:

- Engine Control Unit
- also called Powertrain Control Module (PCM)
- Transmission Control Unit - TCU
- Telephone Control Unit - TCU
- Man Machine Interface - MMI
- Door Control unit
- Seat Control Unit
- Climate Control Unit

Managing the increasing complexity of ECUs and number of ECUs in a vehicle has become a key challenge for OEMs.

Car heater works like the reverse of the normal cooling radiator - in fact the heater is like a small version of the radiator that's on the front of the car - the hot water from the engine block goes into this small radiator and the heater fan blows air thru it into the car - the hot heater radiator loses heat into the car.

3. Experiment results

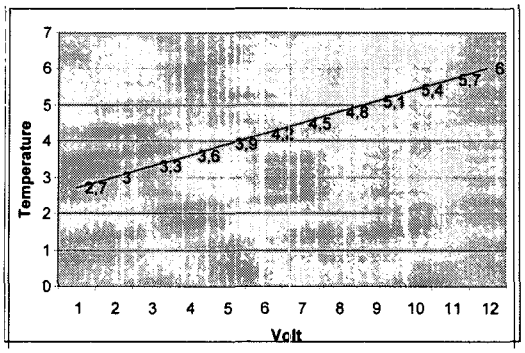
All ECU is produced to make comfortable and safe driving. But none of them provides condensation problem before starting engine. ESCC takes care about clearing car glasses for all time. Principle of algorithm has exclusively smart energy economize function that allows system works for 24 hours per a day. System begins to heat the window, only in critical moment (critical moment- moment when coefficient of temperatures and humidity are close to dew-point). Heating proceeds step-by-step, that does not let accumulating moisture on the glass. This system has many benefits, as integration to one of the already installed ECU, supported alarm-function (one of the function for saving energy) and e.t.c.

On the picture 1, is the graph of glass heating, by dew-point equal to -6ºC (temperature - 10 ºC, humidity - 30%)

The system turns on the heater before 3 ºC to dew-point, and heating up every 0.3 ºC until 12 volts, therefore averts a breath.

In the night about 5-6 hours, it is not useful to control condensation. ESCC supports a "SLEEP" mode. This function makes provision for saving more energy. The "Alarm" function returns the system to online mode. Before a driver comes back to vehicle, all glasses will be clear.

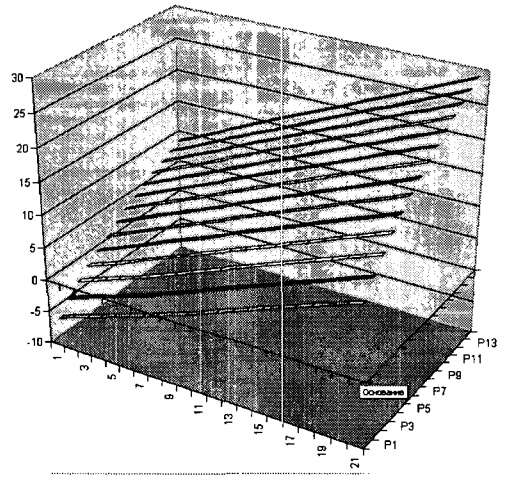
In the following part we can observe the certain results. Referring to the dew-point table, we can compare device working in real condition.



Pic.1

Table 1.

	Humidity				
°C	30%	35%	40%	45%	50%
10	-6	-4,2	-2,6	-1,2	0,1
11	-5,2	-3,4	-1,8	-0,4	1
12	-4,5	-2,6	-1	0,4	1,9
13	-3,7	-1,9	-0,1	1,3	2,8
14	-2,9	-1	0,6	2,3	3,7
15	-2,2	-0,3	1,5	3,2	4,7
16	-1,4	0,5	2,4	4,1	5,6
17	-0,6	1,4	3,3	5	6,5
18	0,2	2,3	4,2	5,9	7,4
19	1	3,2	5,1	6,8	8,3
20	1,9	4,1	6	7,7	9,3



Pic2.

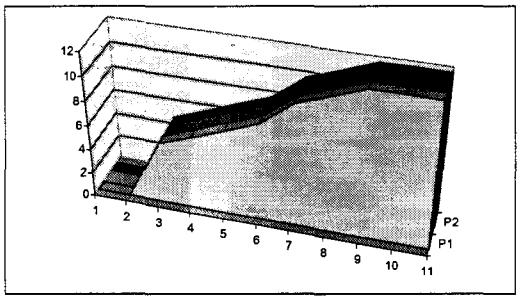
On the picture 2 is represented the dependence of dew-point of temperature and humidity. Diagram on the picture 3 shows a difference between ideal and real working.

T1	15
T2	7.1/7.5/8.2/8.5/8.9/9.4/9.8/10.2/10.7/10.9/11.2
H	75

T1- temperature in the car

T2- temperature of glass

H- Humidity



As showing on the diagram working of system is a same as ideal.

On the table 2 and 3 is difference between ideal and real-working information of voltage and temperature.

Table 2 (Voltage)

ideal	0	0	5	6	7	8	10	11	12	12	12
real	0	0	5	6	7	8	10	11	12	12	12

Table 3 (Temperature)

ideal	7	8	8	9	8,9	9	9,8	10	11	11	11
real	7	8	8	9	8,9	9	9,8	10	11	11	11

Table 2- voltage, Table 3- temperature

4. Conclusion

In my work, I designed a new device to control condensation on the glass. Software was written in C language. CPU Atmega 128L is ideal for this system. The reason is Atmega 128L has 8 bit ADC on-chip, and prize is very low. ADC (analogue to digital converter) was used as pins connections to temperature and humidity sensors.

LCD guaranteed a full comfortable to use ESCC. Using system take 10 years old child knowledge.

The system worked without any problems for 24 hours and results were incorrect only twice with minimum errors for all time.

I designed an EPU as power supply to system for 5 volts. EPU was stable for all time. Also, I designed a box to make experiment, where heater was original glass of car.

Making auspicious conditions to condensation on the glass allows to understand that ESCC is satisfies the requirements. All project takes knowledge by neural networks, C programming, logic and computer design fundamentals, VHDL programming.

Reference

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