

Automatic Fountain Solution Mixing and Composition Control of Dampening System for Lithographic Printing

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ABSTRACT: The objective of our project is to design an Automatic fountain solution mixing and Composition (pH, Conductivity) control of dampening system for Lithographic printing (Web and Sheet fed Offset). This dampening system can be used for avoiding the problems of printing due to dampening solution. Introduction of this dampening system changes the quality of a printing product. In present continuous dampening pumping system is used in printing Industry. During printing the composition of fountain solution changes due to ink feedback to dampener system, paper dusts and other are printing related interactions. The influence of pH and conductivity of fountain solutions on the quality of dot, line and text raggedness was investigated Fountain solutions are normally buffered at specific pH levels of 4-5.5. In present printing industry the fountain solution composition separately checks the fountain solution and takes the trouble shooting actions. By introducing this type of Dampening system we adjust the composition of fountain solution automatically by pH and conductivity sensor. We introduce sensors to measure composition (pH, conductivity) with fountain freezing duct, when reducing composition of any component it automatically feed to duct by sensor through valve from component pan. The goal of this project is to avoid the printing problems related to dampening solution so reduce the paper waste and reduce cost also.

KEYWORDS: Automatic fountain solution, dampening system, conductivity sensor, valves, printing problems.

I. INTRODUCTION

A mixture of water and other chemicals distributed by the dampening system on a printing press used in offset lithography. Lithographic printing operates on the principle that oil and water do not mix to any great extent; offset presses first treat metal printing plates with a fountain solution, which works to desensitize the non-image areas, rendering them ink-repellent. The fountain solution is applied to the plate through a series of rollers in a variety of configurations. Introduction of our dampening system changes the quality of a printing product. In present continuous dampening pumping system is used in printing Industry. During printing the composition of fountain solution changes due to ink feedback to dampener system, paper dusts and other print related interactions. This in turn influences the pH and conductivity of fountain solutions on the quality of dot, line and text raggedness was investigated Fountain solutions are normally buffered at specific pH levels of 4-5.5. In present printing industry the fountain solution composition separately checks the fountain solution and takes the trouble shooting actions. By introducing this type of Dampening system we adjust the composition of fountain solution automatically by pH and conductivity sensor. We introduce sensors to measure composition (pH, conductivity) with fountain freezing duct, when reducing composition of any component it automatically feed to duct by sensor through valve from component pan.

II. RELATED WORK

Glatfelter 'Technical Bulletin Issue 2005-1 first published May 2002. Revised February 2004, the article named —Fountain Solutions; pH and Conductivity points to some facts about Fountain Solutions Modern fountain

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solutions generally consist of a concentrated solution of chemicals that are diluted, in the pressroom, to the working concentration. Typically, we might add one to six ounces of concentrate to a gallon of water. The extent of the dilution varies depending on the actual concentration of the chemicals in the concentrated solution. While we most often encounter acid-based fountain solutions, there are also neutral and alkaline-based solutions used in certain industry segments, specifically the non-heat web offset markets such as newspaper printing.

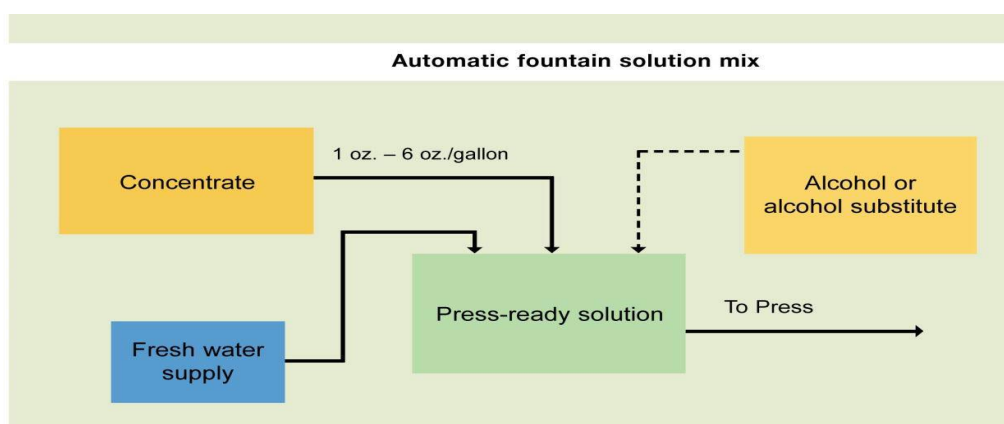


Fig.1 Automatic fountain solution mix

The table shows the typical acid fountain solution composition. Phosphoric acid has always had a unique role in fountain solution chemistry, but it has also been cited as a possible cause of catalyst poisoning in the afterburners of web offset press ovens. For that reason, alternatives such as citric acid are used. What keeps the non-image area water receptive is the presence of a chemical known as a desensitizer gum arabic has proven to be the best over time. It works best in an acidic environment, hence the reason for having the phosphoric, or other acid present. Buffering agents are materials that help keep the acidity, as measured by the pH of the solution, at a fixed value, regardless of its concentration. We'll come to this important concept in just a moment. Corrosion inhibitors are necessary because the dampening solution can be very aggressive toward metal parts on the press and supporting equipment. Likewise, bactericides are necessary in order to prevent unwanted bacterial and algae growth in the dampening system. This is especially critical in solutions that are neutral or alkaline in pH. The wetting agent is a rather recent addition to the mix. At one time, it was found necessary to add alcohol, typically isopropyl alcohol (isopropanol), to the diluted solution such that the resultant mix contained anywhere from 5%-25% alcohol. The purpose in doing this was to improve the ability of the solution to wet out the dampening rollers and nonimage areas of the printing plates. Because of insurance concerns (the alcohol is very flammable), alcohol is rarely used in North America, at least at the high concentrations formerly used. Other chemicals, known as wetting agents, are now used and may be present either in the fountain solution concentrate itself, or added to the diluted solution at press side. Some wetting agents have been known to create foam problems in the circulation system, hence defamers might also be found in the fountain solution concentrate. In many pressrooms, all the dilutions and additions generally take place automatically. The amount of concentrate to use (typically between 1 – 6 ounces/gallon) is determined by the composition of the fountain solution.

When alcohol substitutes or replacements were introduced, it was often found that lesser amounts were needed, and it was possible to squeeze it into the concentrate itself. These solutions became known as One Step solutions. Everything was in one container, which simplified the mixing equipment, but more of the concentrate was required. One Step or Two, it doesn't Matter. What is important, and is often overlooked, is that the concentration of all the active ingredients must be maintained at the proper level. Overdosing, particularly with a One Step solution, to correct

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Vol. 7, Issue 2, February 2018

one problem, will likely create additional problems because the other components will then be present at elevated concentrations. We mentioned earlier that the main desensitizing agent, gum arabic, is most effective at maintaining acidic pH values.

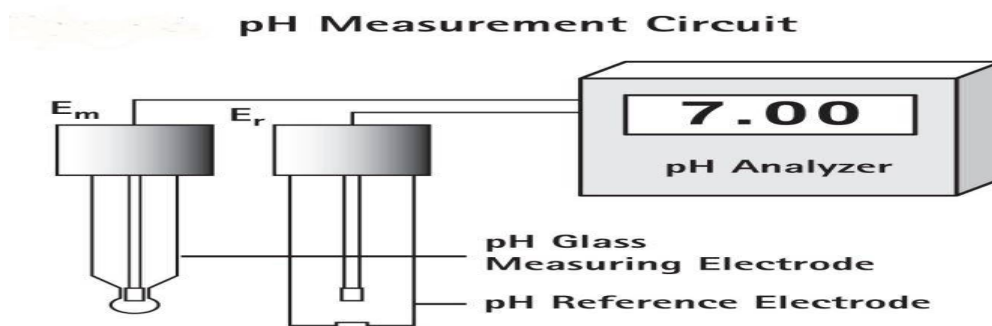


Fig 2: pH Measurement circuit

Since the current that passes through the half-cells and the solution being measured is extremely small, the pH meter must have a high internal impedance, so as not to "drag down" the millivolt potential produced by the electrodes. This low current flow ensures that the chemical characteristics of the solution being measured remain unaltered. A galvanic potential is formed due to charge exchanges occurring at the phase boundaries of the glass measuring electrode. In effect, the pH sensor assembly forms a galvanic cell using two metal conductors (lead wires of the measuring and reference electrodes) interconnected through their respective electrolyte solutions, and the media. Since phase boundaries cannot be measured individually and there are always more than two phase boundaries present, the pH meter measures the overall potential. The overall potential is comprised of the following elements:

- Metal lead-out wire of the measuring electrode
- Electrolyte of the measuring electrode
- Diffusion potentials at solid/solution interfaces
- Electrolyte of the reference electrode
- Metal lead-out wire of the reference electrodes

III. COMPOSITION CONTROLLING SYSTEM

The composition controlling system consists of pH, conductivity sensors and a micro controller. The conductivity and pH sensor senses the slightest changes in the concentration of the solution. There are two supply tubes present with a controlling valve. One supply water and the other acid. A micro controller is used to connect with the sensors and supply tubes. When pH or conductivity changes the micro controller sends a signal to the supply tubes. The adjustable valves open according to the signal. When pH is less it opens the water supply and when pH is more the acid is poured. The pH measurement is comprised of two half-cell, or electrode, potentials. One half-cell is the pH sensitive glass measuring electrode and the other is the reference electrode. Just as the two half-cell potentials of a battery are required to complete a circuit so does a pH sensor.

Since the current that passes through the half-cells and the solution being measured is extremely small, the pH meter must have a high internal impedance, so as not to "drag down" the millivolt potential produced by the electrodes. This low current flow ensures that the chemical characteristics of the solution being measured remain unaltered. A galvanic potential is formed due to charge exchanges occurring at the phase boundaries of the glass measuring electrode. In effect, the pH sensor assembly forms a galvanic cell using two metal conductors (lead wires of the measuring and reference electrodes) interconnected through their respective electrolyte solutions, and the media. Since

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phase boundaries cannot be measured individually and there are always more than two phase boundaries present, the pH meter measures the overall potential.

Water Solenoid Valve

These valves are basically used pneumatic actuators as circuitry valves. Pneumatic actuators and cylinders cannot be operated without these valves. These valves work perfectly with compressed lubricated air and non-lubricated air and gases and temperature required is 90 degree maximum. Pressure vacuum is required between 0-10 bars.

Control Unit

In our project the main device is a micro controller. It is used to control the whole unit of this project. The micro controller is connected to the control unit. The control unit is connected with the battery to get the power supply. Microcontrollers are destined to play an increasingly important role in revolutionizing various industries and influencing our day to day life more strongly than one can imagine. Since its emergence in the early 1980's the microcontroller has been recognized as a general purpose building block for intelligent digital systems. It is finding using diverse area, starting from simple children's toys to highly complex spacecraft. Because of its versatility and many advantages, the application domain has spread in all conceivable directions, making it ubiquitous. As a consequence, it has generate a great deal of interest and enthusiasm among students, teachers and practicing engineers, creating an acute education need for imparting the knowledge of microcontroller based system design and development. It identifies the vital features responsible for their tremendous impact; the acute educational need created by them and provides a glimpse of the major application area.

Battery

In our project we are using secondary type battery. It is rechargeable Type. A battery is one or more electrochemical cells, which store chemical energy and make it available as electric current. There are two types of batteries, primary (disposable) and secondary (rechargeable), both of which convert chemical energy to electrical energy. Primary batteries can only be used once because they use up their chemicals in an irreversible reaction. Secondary batteries can be recharged because the chemical reactions they use are reversible; they are recharged by running a charging current through the battery, but in the opposite direction of the discharge current.

IV. FOUNTAIN SOLUTION MIXER

The mixing system consists of mainly a dc gear motor. This motor is used to mix the solution right and make it uniform. Slow and powerful mixing is given by the motor. The motor works after the acid/water is supplied to the solution and stops when the concentration is made correct. The operating voltage is 12V, the average speed is 70rpm and Torque is 40Nm. The ink film separator is used to separate ink from the solution. Nowadays the ink film separation is not used commonly. When we were researching for a way, we found a technique used in oil industries to separate oil and water. The same idea with some modification can be used in printing processes. The system is called parallel plate ink film separator. The system consists of a parallel plate which separates the ink from the solution by pumping the solution forcefully. Since the density of the ink is less than water it goes to the top and makes a layer of ink on the surface. This layer is managed to expel through a tube. The fresh solution can be driven to the fountain tank.

V. PROJECT STRUCTURE

In present printing industry the fountain solution composition separately checks the fountain solution and takes the trouble shooting actions. By introducing this type of Dampening system we adjust the composition of fountain solution automatically by pH and conductivity sensor. We introduce sensors to measure composition (pH, conductivity) with fountain freezing duct, when reducing composition of any component it automatically feed to duct by sensor through valve from component.

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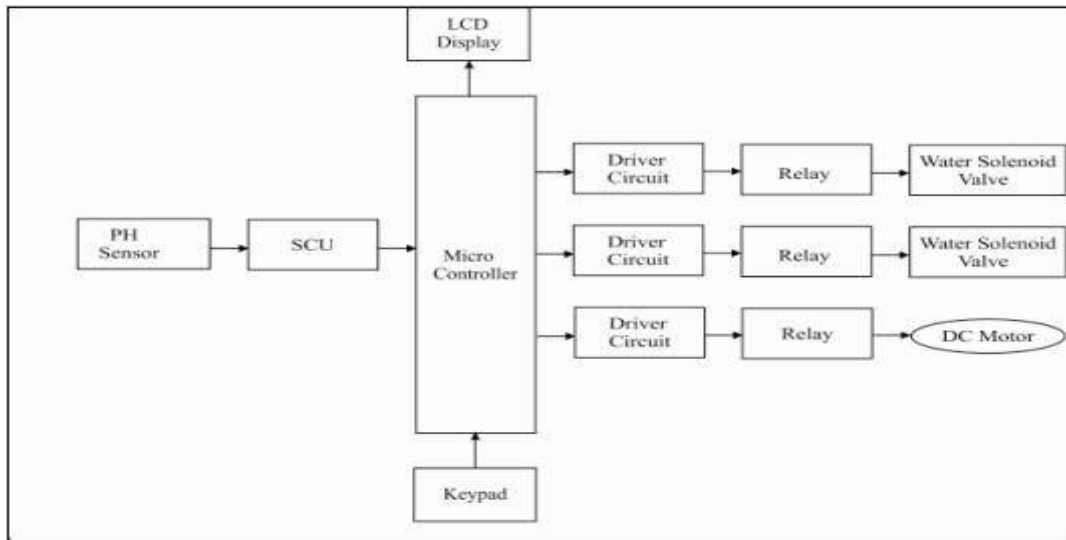


Fig 3: Project structure

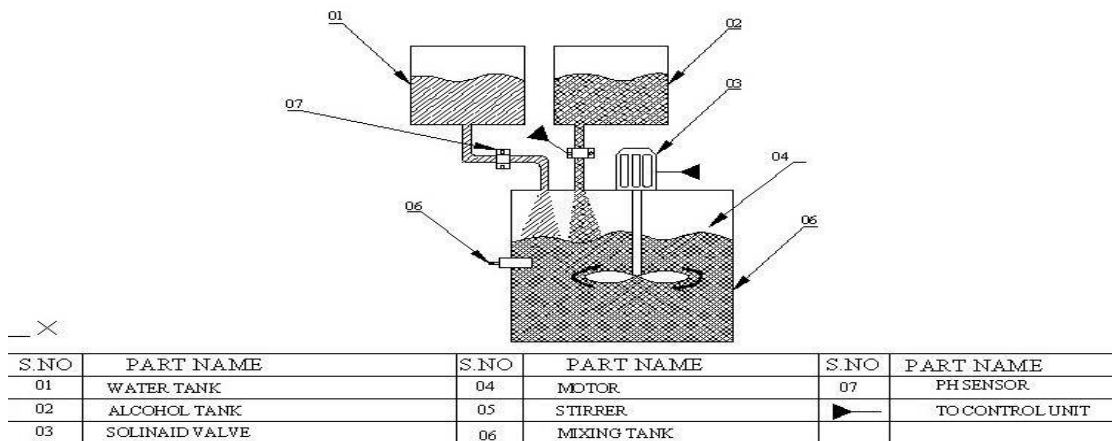


Fig 4: Automatic fountain solution mixing and composition control of dampening system for lithographic printing

The main part of the design is the tank which carries the dampening solution in which concentration control and mixing takes place. Now the dampening solution when required is fed to the tank where the mixing of the fountain solution occurs. The dampening solution's pH is sensed and passed into the micro controller. The required pH is set in the micro controller. If the pH is low or above the value the micro controller is programmed to manage the pH levels. If the pH is low metered amounts of water is fed till the pH rises to the wanted level. The pH is sensed instantaneously and data is passed to the micro controller, this in terms will help the micro controller identify when the pH reaches required level. If the pH is high metered amounts of ink is pumped in the same way. Thus in this way the pH is managed. The motor is constantly occupied in mixing the dampening solution with the water or alcohol being pumped. After the pH is properly set all of the dampening solution is pumped to the press. The largest component of fountain solution is water, and it is important that the water used be as free from impurities as possible. The ink film separator separates the ink dissolved in the dampening solution using stroke's law. The dampening solution on entering the ink film separator, the ink having

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Vol. 7, Issue 2, February 2018

low density rises above the dampening solution and yet heavy particles get accumulated in the base. Now we can pump away the unnecessary film out and the required dampening solution islet into a container and is collected.

Designing the Mixing System

The motor with the specifications are connected with a small wind fan and is connected externally from the tank. The motor is placed in a stand and made adjustably dipped in the solution and can be removed if necessary. The dc power is given to the motor with another circuit. The micro controller doesn't control the motor.

Designing the Ink Film Separating System

Free ink particles can be removed by gravity separation given proper quiescent flow conditions. Gravity oil/water separators exploit the differences in specific gravity between the fluids by providing adequate retention time for the less dense oil globules to rise to the surface of the water. The theory of this type of separation is based on the rise rate of oil droplets in the water and the surface-loading rate of the separator. The surface-loading rate is the ratio of the flow rate to the surface area of the separator. If the oil globule rises towards the surface of the separator faster than the surface loading rate, the oil will reach the surface and can be skimmed off mechanically.

Parallel Plate Oil/Water Separators

Parallel Plate Oil/Water Separators offer improved performance by increasing the horizontal surface area of the separator and creating less turbulent flow. Conventional channel units can often be retrofitted with parallel plates to either improve the wastewater effluent or allow for higher flow rates of wastewater. Separators with Parallel Plate Coalescing Media can allow flow rates up to three times that of conventional units.

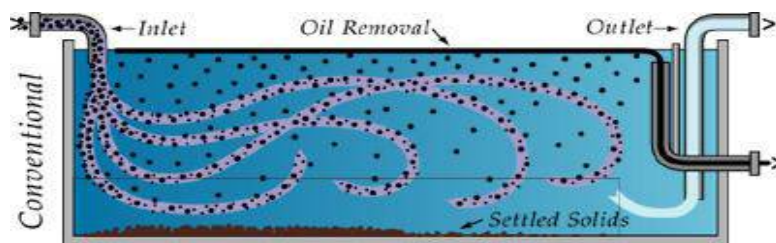


Fig 5: conventional oil/water separator

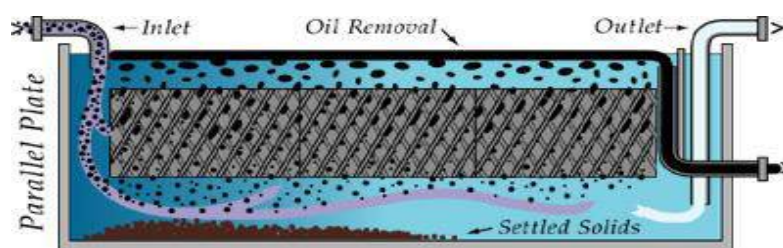


Fig 6: parallel plate ink film separator

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Vol. 7, Issue 2, February 2018

VI. CONTROL SYSTEM

The control system consists of the power supply, relay circuit, pH measurement circuit and the LCD connection.

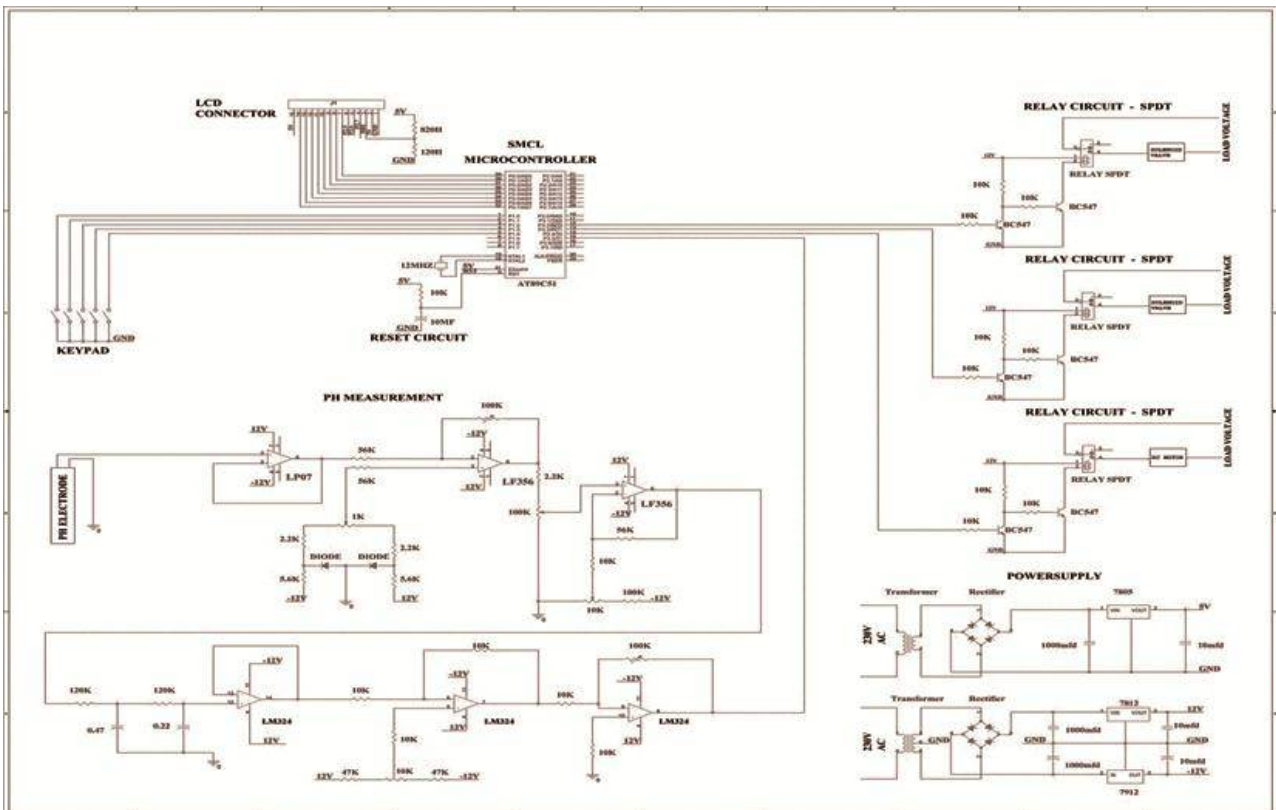


Fig 7: Control system

VII. CONCLUSION

Our proposed project “Automatic fountain solution mixing and composition control of dampening system for lithography” is a technique to cop up with these problems. To complete this project we must have a bit of technical knowledge of subjects such as micro controller, embedded C programming and also machine designs. So we had to increase our knowledge on these subjects. The next step of our project was to fabricate the proposed design. Our design first proposed had a several defects in it one such defect was the removal of ink film which gets dissolved in the dampening solution during press run. We did a research on methods of separating oil from water and found out that ASI oil water separators were used in petrochemical industries. Another technique used in separating oil from water is the parallel plate oil water separator. We also learnt from research that this parallel plate oil water separator could definitely be used in printing industry as ink when emulsified in dampening solution is same as oil emulsified in water. While fabricating it there were many factors that we had to keep in our mind, so that it is best adapted in the practical world. Thus we modified the layout if necessary. We can now save gallons of dampening solution, thus cutting cost of materials brought into the press room and also saving energy.



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