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RESEARCH ARTICLE

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AUTOMATIC ROAD ENERGY SAVER

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ABSTRACT

Nowadays, the conventional energy is decreasing day by day. So for using energy in street lights the energy can be generated from vehicles moving in the road by installing a mechanical dynamo in the road. The energy is stored and used during the eve to switch on the street lights. The system is designed in such a way that the lights will be switched on in the evening before the sun sets and they are switched off the next day morning after there is sufficient light on the roads. All lights are equipped with the energy-saving function which will turn itself to the dimming level automatically after the visitors' car leaving. As conclusion, around 77%-81% reduction in power consumption can be achieved through this proposed automatic road energy saver system for energy efficiency system design.

Keywords: Energy efficient system, road energy saver, efficient street lighting system, energy efficient system

I. INTRODUCTION

Street lighting energy is one of the major demand of energy now-a-days. Moreover inefficient use of energy lead to energy wastage. In this project power is generated with the help of moving traffic on the road by the conversion of mechanical energy into electrical energy. One mechanical dynamo is installed on the road near the speed breakers which converts the mechanical energy into electrical energy. The output from the dynamo is connected to the dc battery to store the energy for further use in the night to switch on the street lights.

Street light is to be switch on automatically in the night and lights are automatically off in the day. Moreover in this project the street light are switched on in half mode at night. Half mode means all the lights are to be in on mode while the rest of lights are to be in off mode and will only be switched on once there is traffic in the road. This will not only stop energy wastage but will increase the efficient use of street lights. For the purpose of road sensing, two pair of infra red sensor are used on the road. When any car cross the road then infra red beam is interrupted and signal is connected to the controller. Controller sense the signal and increment the counter. Counter display the total number of vehicle on road. When counter shows a 0 number then road lights went to the half mode.

II. CONSTRUCTION

Here the shaft of the dynamo is placed like a speed braker. Movement of vehicle is used to

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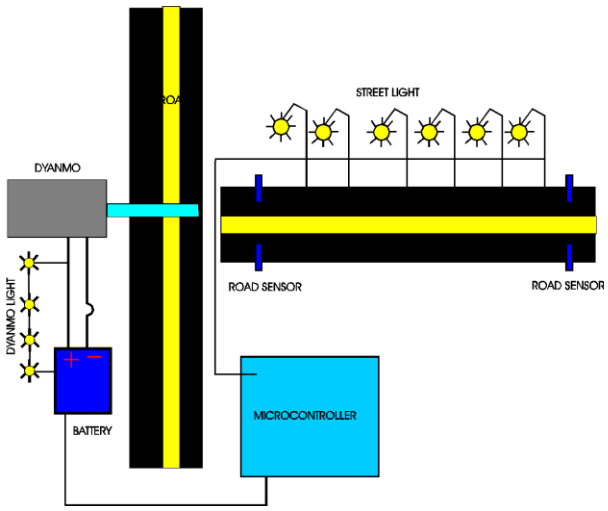
rotate the dynamo shaft and electricity is generated. This voltage is to be stored in the chargeable battery.

In the night lights are automatic on with the help of photovoltaic switch logic/twilight switch.

But all lights are not on, only half lights are on. Other half lights switch on automatically when any vehicle move on the bridge, when there is no vehicle on the bridge then lights are off automatically.

Two infra red sensor's are used to check the movement of vehicle. When first infra red sensor is on then lights are on and when second sensor is interrupted then lights are off. The no of vehicles can be counted by using a counter at the exit gate.



III. CIRCUIT DIAGRAM

In this project 89s51 microcontroller is used, family member of the 8051 family. Power supply requirement of the microcontroller is 5 volt dc . For this purpose the battery voltage is converted into 5 volt dc with the help of the 7805 regulator circuit. One capacitor is grounded from the regulator for filtration purpose which reduces the noise . Output of the regulator is connected to the pin no 40 of the controller directly. One 12 Mhz crystal is connected to the pin no 18 and 19 of the controller to provide a oscillation signal. Two capacitor are grounded from the crystal to reduce the noise

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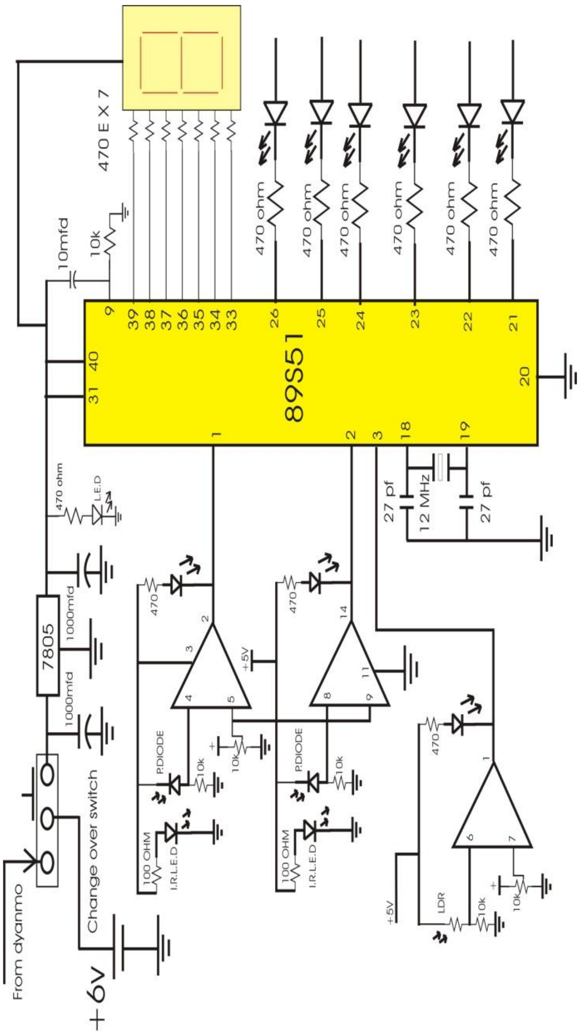
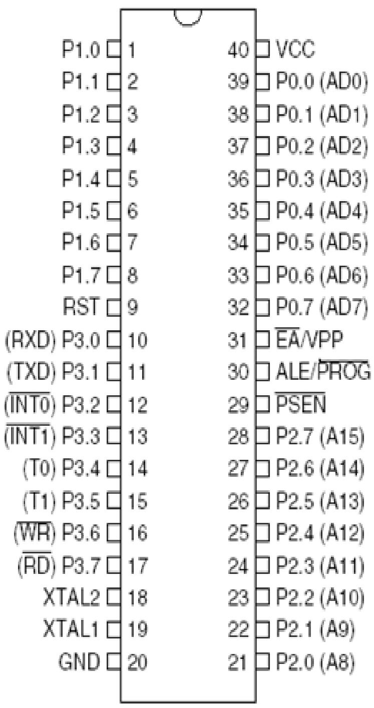


Two logic circuit has been introduced in this project. One is light sensitive logic and second is road sensor logic. When sensor is in dark/dusk then all the lights are on and when sensor is in dawn/lighted condition then all the lights are off. This is done by the light sensor (LDR). LDR is a light dependent resistor , when light fall on the LDR then LDR offers a low resistance and when LDR is in dark then LDR offers a high resistance. Here in this project we use the LDR with npn transistor circuit. Emitter of the npn transistor is connected to the ground and collector is connected to the pin no 3 of the controller. When LDR is in light then there is low positive on the base of the npn transistor and collector is become more negative. When LDR is in dark then there is no base voltage and hence collector become more positive. Microcontroller sense this change of voltage and switch on the output led which is connected to the port 0, Output led's are connected with the port 0 through the resistance in series, here in this we use 6 LED . Common point of the LED is connected with the positive line. Out of 6 only three LED's are on .

The second part of this project consist of infra red sensor. In this logic when any car cross the first ir sensor then all the led are on and if the traffic continuous then led are on if the no car on the road then again three led are on and three are off. This saves the unnecessary energy wastage through street lights during the lean traffic period. For this purpose two IR sensor circuit (one infra red sensor and one photodiode circuit) are used with this project.

When light fall on the photo-sensor then resistance of photos sensor become low and hence negative voltage is applied to the controller. When any car cross the photodiode and then photo diode resistance become high and hence signal is changed on the pin no 2 of the controller. As the controller sense this change of signal on pin then all the lights are switched on from the half mode state.

PDIP



PLCC

MICROCONTROLLER DETAILS

The AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash Programmable and Erasable Read Only Memory (PEROM). The device is manufactured using Atmel's high density nonvolatile memory technology and is compatible with the industry standard MCS-51™ instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C51 is a powerful microcomputer which provides a highly flexible and cost effective solution to many embedded control applications. The AT89C51 provides the following standard features: 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, two 16-bit timer/counters, five vector two-level interrupt architecture, a full duplex serial port, and on-chip oscillator and clock circuitry.

In addition, the AT89C51 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port and interrupt system to continue functioning. The Power down Mode saves the RAM contents but freezes the oscillator disabling all other chip functions until the next hardware reset.

IV. RESULTS

The lighting module is implemented as shown in Figure. It is modified from the product of PIR security lamp. The PIR sensor is covered by a white plastic and also a black cover to block the light from the lamp. The inner circuit is modified to have the micro-processor, the relay circuit and the network interface circuit. The TRIAC circuit is implemented in a metal case which is separated from the housing of the module. Here a potential meter with a knob is installed in the TRIAC circuit to let the user adjust the dimming level of the light.

The PIR sensor detects the approach of the visitor and then the relay circuit turns to the ON state. The lighting works in the maximum intensity mode which consumes over 300 mA of current The test of the lighting module after the visitor leaves.

The PIR sensor is covered by a box to simulate the leave of the visitor. The relay circuit turns to the OFF state. The lighting is controlled by the TRIAC circuit. The current consumption is reduced to 100 mA. It is then verified that the energy-saving mode is functional work.

The results show that the implemented module is functional work and the proposed module is useful for the energy saving purpose in the lighting space. The same module has been implemented in the project circuit in terms of LED's used as street light.

V. CONCLUSION

The implementation of this project can be done in toll tax region and near speed breakers. This will generate electricity which can be stored and used in night. If there is excess electricity it can be even fed to the grid by using inverters. In future more realistic results can be obtained by using net metering systems. By efficient usage of vehicular motion to electricity it is possible to have a net zero energy consumptions for street light with least energy wastage. One thing need to be kept in mind that slow constant speed is required to move over the speed breaker having the shaft of the dynamo. So it will be useful to be implemented in places like toll tax or parking of any commercial complexes like shopping mall, schools, colleges etc. as the vehicular speed in slow in such regions.

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