



# Bidirectional Visitors' Counter with Automatic Room Light Controller

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## ABSTRACT

This paper presents a bidirectional visitor counter with an automatic room light controller. The project work is to control a circuit that can sense the movement of people in and out of a room, office, hall, etc. It is made to prevent unnecessary electric power waste in houses, offices, and factories. The 8051 microcontroller and infra-red sensor are employed for this work. The sensors are placed on the single door entrance to sense the movement; the output of the two sensors is connected to the microcontroller, which acts as the central processing unit of the whole system. Managing the movement of people helps to maximize employee efficiency, effectiveness, and time savings.

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## Introduction

Micro-controller has found a wide variety of applications in today's fast-changing world. They can be used in our offices, homes, factories, schools, etc., to control objects, signals, or industrial processes depending on how the controller is programmed to process the input signal given to it by the external system. To increase the widespread use of micro-controllers in day-to-day activities, bidirectional visitors' counter with an automatic room-light controller has been developed. It aims to do a controller-based module that counts the number of persons visiting a particular room, hall, mall, sports venue, or religious hall with a single door entrance, and it lights up the room accordingly [1].

This is because there is a continuous need for automatic appliances with the increase in the standard of leaving and there is a sense of urgency for developing circuits that would ease the complexity of life; in other places, there is a need to know the number of people present in a room to avoid congestion. This model proves to be helpful; it's far a reliable version that takes over the challenge of counting the quantity of visitors in the room passing through a single door and additionally turn the room light ON whilst there is a minimum individual within the room and turns OFF while the room is empty [2]. The 8051 microcontroller does the above task. It receives the signals from the infrared sensors and processes the call according to the program stored in its ROM. It contagiously monitors the infrared receivers; outputs, when an object passes through the IR, receives, the IR rays falling on the

receiver are obstructed, and the microcontroller senses this obstruction.

### The hardware platform

The hardware consists primarily of a microcontroller, infrared transceiver, liquid crystal display, and relay module, which are addressed in detail and their essential functions.

(i) IR Transceiver: Two infrared sensors, each with an IR transmitter and receiver, have been used to implement the suggested system. When forward biased, the IR transmitter consists of a light-emitting diode (LED) of a solid state gallium arsenide device that emits a beam of radiant flux, in a specially built recombination location sandwiched between the P- and N-kind materials, electrons from the N-place will recombine with additional holes from the P-substances while the junction is forward biased. Electricity is radiated far from the device inside the form of photons at some point during this recombination. The produced photons can either be reabsorbed within the shape or leave as radiant electricity on the tool's surface. The gadget emits IR radiation with a typical peak of 0.9 m, which perfectly matches the response of a silicon photodiode (PD), which acts as an IR receiver [3].

The IR receiver is made up of solid-state silicon photodiode (PD), it is a two-terminal semiconductor P-N junction device, and it is designed to operate in reverse biased mode. The operating principle of a semiconductor PD is that when a reverse-biased P-N junction is illuminated, the current varies almost linearly with the light flux. The device consists of a P-N connection embedded in

clear plastic, as shown in figure 2 below. Radiation is allowed to fall upon one surface across the junction; the remaining sides of the plastic are painted black. When the light energy bombards the P-N-junction, it dislodges valence electrons. The lighter (IR) striking the junction, the larger the reverse current in the diode. Using IR LED is that infrared beams are not visible to human eyes, and other sources in the environment do not easily trigger them [4]. So whilst the IR rays are interrupted by means of any character, the microcontroller will acquire a high pulse from the IR receiver connected at its port.

(ii). Microcontroller: This is the entire system's central processing unit (CPU). This is accomplished using 8051 microcontrollers, sometimes known as ATmega 328 [5]. The microcontroller reads the data input from the two infrared sensors and calculates the number of people. The number of people counted is subsequently sent to the liquid crystal display (LCD), which displays the result on the screen. The relay module attached to the microcontroller also controls the room light automatically. It turns on the light when the person count is greater than or equal to 1 and shuts it off when the count is zero in the morning.

(iii). Liquid Crystal Display: A  $16 \times 2$  alphanumeric liquid crystal display (LCD) shows alphabets and numbers on two lines, each with 16 characters, as the output unit of bidirectional visitors count. This exhibit should be set up outside the room. It suggests a variety of messages, such as "person counter increased," "man or woman counter decreased," "many men and women in room = xyz," and so on.

(iv). Relay Module: A 12 V relay is used in the system to allow the 8051 microcontrollers to regulate a high voltage AC load such as a 220 V electric light or any other load. Because the microcontroller cannot directly operate the relay, a relay driver circuit is used, which consists of a transistor (NPN), a resistor, and a diode-connected, as shown in the diagram below. SFA 2001 [6, 7].

(v). Power supply unit: The development of the power supply required for any system is a key phase in its design. A 12V/500mA step-down transformer, a bridge rectifier (full-wave bridge), 0.01F/35V capacitors, and 7805 voltage regulators are used in this system.

The main supply voltage is fed to the primary winding of the step-down transformer, which stepped it down to 12 V. The transformer's output voltage flows to the rectifier, which converts it to DC voltage. The 0.01 F capacitor smooths down the voltage before passing it on to the 7805 voltage regulator, which regulates it to 5 volts. Which voltage is necessary for the entire controller circuit components? [8, 9]. The 7805 datasheet recommends a 0.01 F capacitor on the output side to avoid transient voltage changes due to load changes, and a 0.33 F capacitor on the input side to eliminate ripples if the distance between the regulator and the load is great.

**Materials and Methods**

In this paper, the main aim is to develop a model for visitor counter; the proposed system block diagram is shown below. The overall mechanism is based on infrared wave interference. An infrared beam is used as the light source. The bidirectional visitor counter has two ports, each with an automatic room light controller and a microcontroller acting as a master controller. As a transmitter, the infrared sensor is employed, it should be installed on one side of the door frame and powered by a 5-volt DC source. Figures 2 and 3 show a comprehensive circuit schematic as well as the system's flow chart. A prototype is developed to explain the technically formed system, as depicted in figure 4

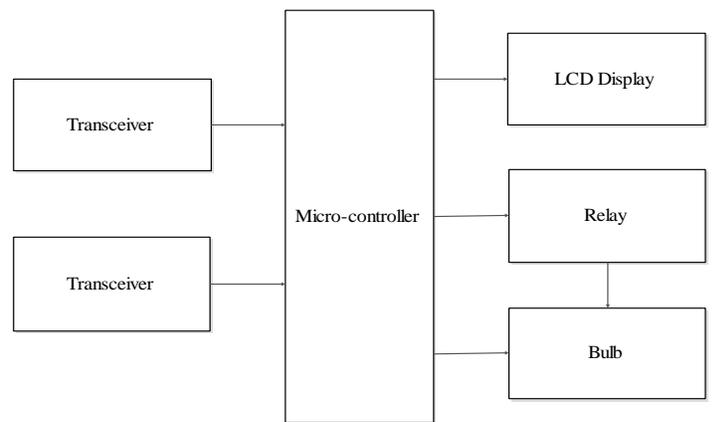


Fig. 1: Block diagram of an automatic room light controller

**Results and Discussion**

The system is connected with a microcontroller which includes all of the components as mentioned earlier. The proposed Bidirectional visitors counter with an automatic room-light controller has been tested and when testing the system in the laboratory, the intensity of the indicator was set at a medium level and it remains constant throughout. Figure 5 presented the system during the process of counting. As can be seen from the system the front opening serve as the entrance while the rear opening will serve as way out. The system was able to count two hundred number of people during the test.

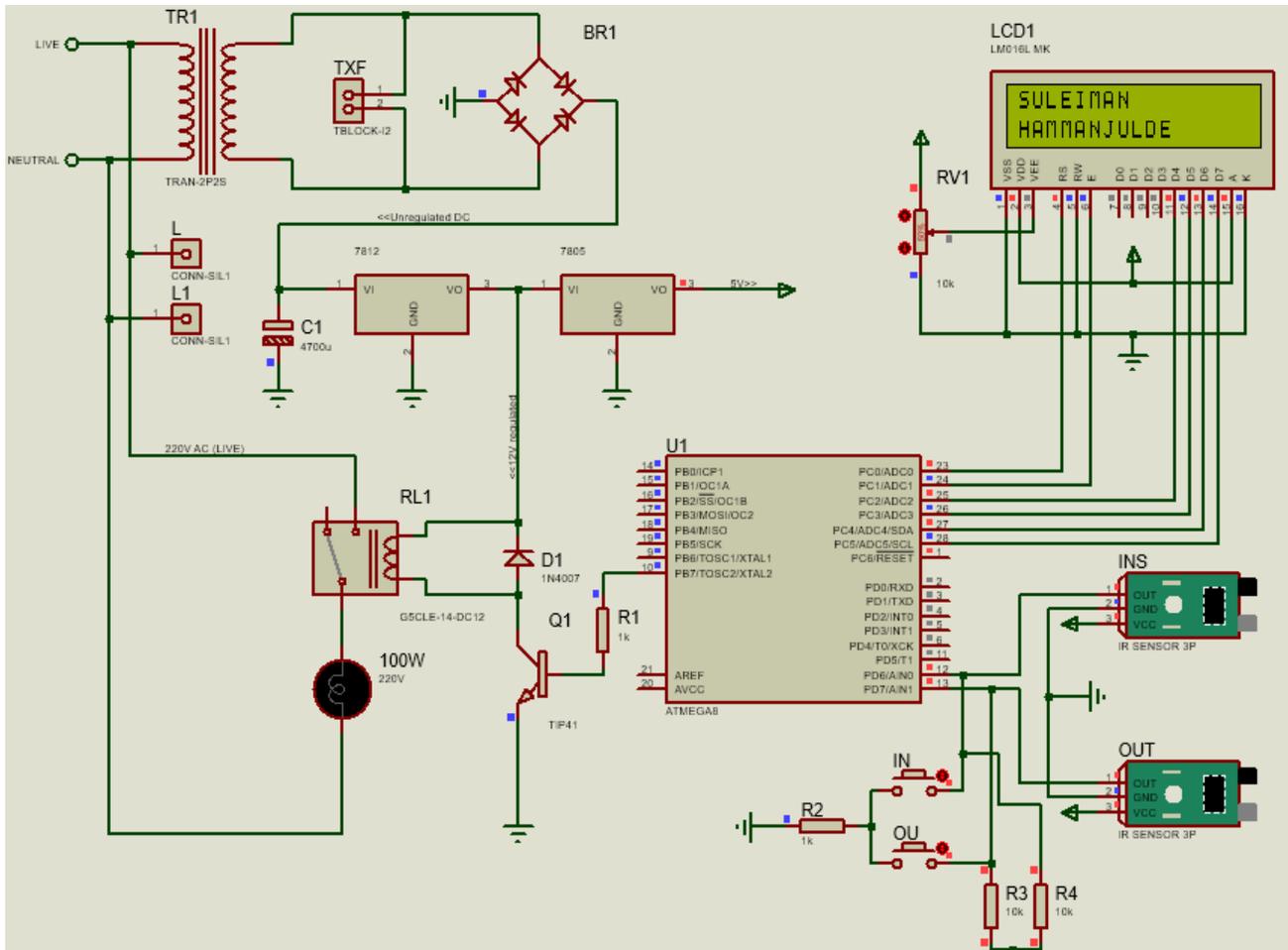


Fig. 2: Complete circuit diagram

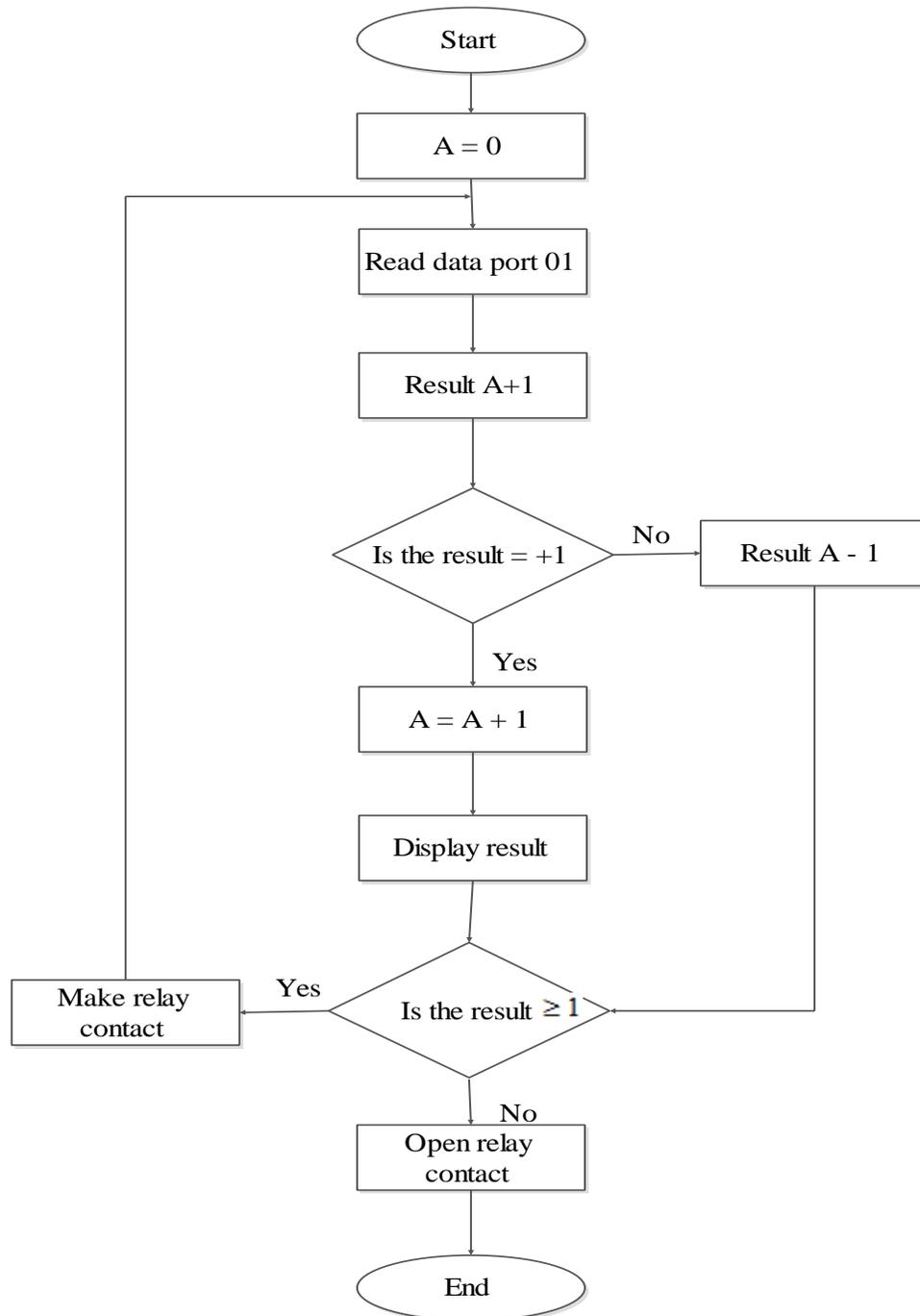


Fig. 3: System flow chart

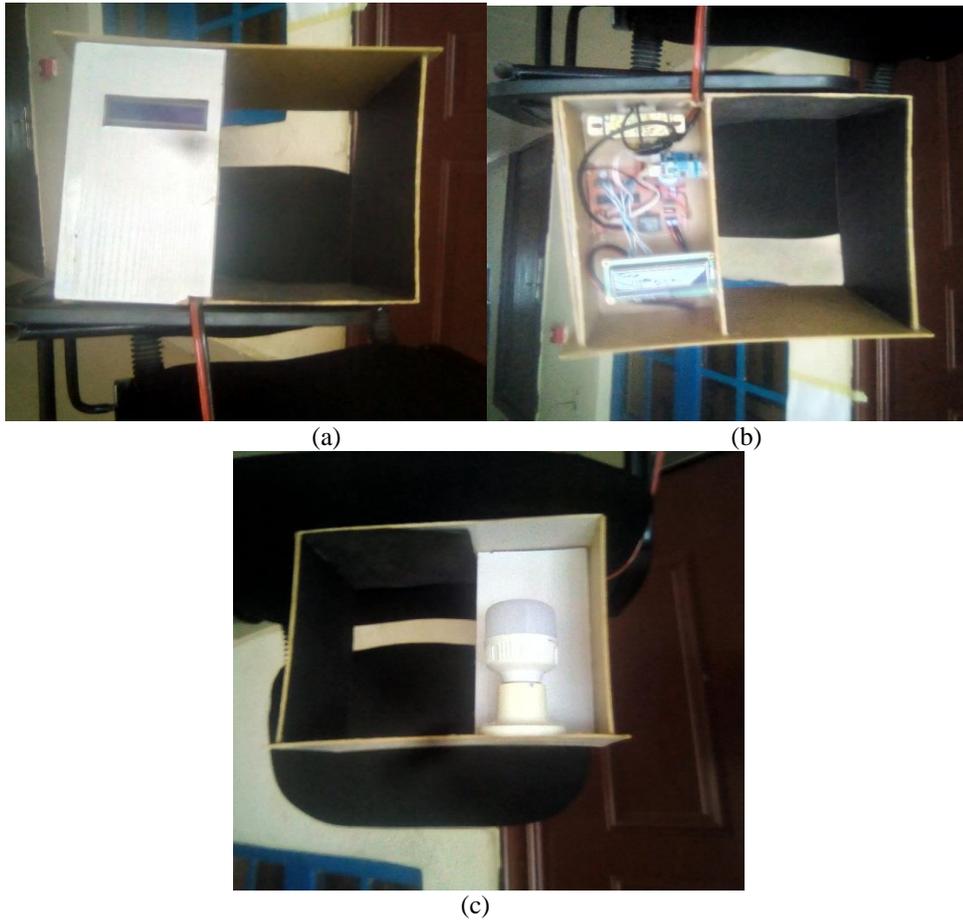


Fig. 4: System prototype



Fig. 6: Counting process



### **Conclusion**

This article implements an architecture for an economic bidirectional visitor counter and IR sensor. It explains how to use microcontroller to power a bidirectional visitor counter and a room light counter. The system is an effective addition for security systems. It may be implemented at sensitive buildings and offices, in addition to visitor counting, automatic room light controller produces amazing efficiency to control the room appliances for energy deficient in under developed countries.

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