

Bidirectional Visitor Counter using AT89C52 with Light Automation and Metal Detection

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Abstract - In Today's world there's an endless need for automatic appliances. Wastage of electricity is one of the critical issues that we are presently facing. We've designed this project known as -Bidirectional visitor Counter with the help of AT89C52 Microcontroller|| to help overcome some of these issues. The primary intention is to create a system where the quantity of individuals coming into or leaving an area is monitored and displayed on a screen. Once someone enters the specified area, count would be increased, whereas on leaving, the count would decrease. IR sensing mechanism is employed to sense the presence of the people and also the counting calculation is finished by a microcontroller. "The microcontroller is employed for identifying either an entry or an exit action and computes (addition or subtraction) to accumulate the exact results". It receives the signals from the sensors, and this signal is operated beneath the management of the embedded programming code that is held in ROM of the microcontroller. The microcontroller endlessly monitors the Infrared Receivers. As soon as any object passes through the sensors, then the IR Rays are mirrored back to the receiver sending an active low signal to the microcontroller. The obstruction can happen in these circumstances, either you obstruct the first sensor (i.e. outside the building) before the second sensor (i.e. that is within the building) this shows that you are entering the building. In contrast, if the opposite approach is used i.e., obstructing second sensor before the first sensor, indicates that your exiting the building. This obstruction is detected by the Microcontroller, computed and displayed by a 16x2 LCD screen.

Key Words: *Bidirectional Visitor Counter, IR Rays/Receivers, Microcontroller, Liquid Crystal Display and Circuit.*

1.INTRODUCTION

With the increase in the standard of living, there is a sense of urgency for developing circuits that would ease the complexity of life. "Visitor counting is basically a measurement of the visitor traffic either entering or exiting places like parking lots, sports venues, etc". Over the years, the usage of Visitor counters has become very positive in terms of monitoring crowd behavior at a particular place. "A tally (or tally stick) was an ancient memory assistance device used to store and file numbers, quantities, or even messages" [4]. "Historical reference is made by Pliny the Elder (AD 23–79) about the best wood to use for tallies, and by Marco Polo (1254–1324) who mentions the use of the tally in China. Tallies have been used for several instances such as

messaging and planning, and especially in people counting, financial and legal transactions". [1]

The tally stick was replaced by the mechanical tally counter which is a device used to incrementally count something, usually passing. One of the most common things tally counters are used for is counting people, animals, or things that are quickly entering and exiting a location. "Later, an electronic tally counter was introduced which used an LCD screen to display the count and push buttons to increase or decrease the count. Currently, as a result of technological innovation, countless types of visitor counters have been introduced to automatically count the quantity of people either arriving or leaving a building at a certain time. Some of these technologies are laser beam, thermal imaging, video camera, and the infra-red sensor. All these sensors perform their role respectively as visitor indicators". These devices are very reliable and accurate in terms of performance as compared to the mechanical and electrical tally counters.[2]

Historically, several well-established institutions such as libraries, community centers, auditoriums, etc., across the globe have encountered various instances related to traffic monitoring. "It has become a necessity to monitor the visitors to carry out the task of human traffic management and estimation of tourist flow to justify accurate results for statistical research and organizational marketing. This in turn indicates the benefaction rate of goods and services by consumers. Therefore, we believe it appropriate to identify these problems encountered by our various organizations and find solutions to them by designing a bidirectional visitor counter. [3] The principal technique for counting the visitors involved hiring human auditors who stood and manually counted the number of visitors who entered or passed by a certain location". This method of human auditing application or human-based data collection was unreliable and was costly. For example, in circumstances where a massive amount of visitors arriving and leaving buildings such as conference rooms, law courts, libraries, malls, and sports venues, etc., are going for human auditors to manually count the number of visitors which may result in inaccurate data collection.

Therefore, many organizations have tried to discover solutions to diminish the inaccuracy in traffic monitoring. It is our intention to design and construct this bidirectional visitor counter with maximum efficiency and make it very feasible for anyone who wants to design and construct this project. Our main objective in this paper includes designing and constructing a visitor counter which will make a controller- based model count and compute the amount of visitors in a building at a specific interval. It is also our objective that this controller base model beeps a warning alarm when the capacity of the building is exceeded. Furthermore, features like light automation to conserve electricity and metal detection to strengthen security have been added. This paper offers the guarantee of the health and safety of the inhabitants in a building at all times since the visitors are assured traffic decongestion.[4] This stratagem supports the reduction of burden on building facilities by instigation of security when the capacity of the building is exceeded. It goes a long way to assist the rescue team or security services to come up with strategic procedures in dealing with emergency issues like people trapped in a structure as a result of hijacks or a collapsing building.

Usually, we see that the design and construction of every single device comes with some restrictions and ours cannot be exclusion. In this paper, our device might calculate multiple people as one if they interrupt the infrared beam at the same time in a linear direction. Hence, it is suggested to be installed at a narrow pathway forcing the entry/exit of one person at a time.[5]“Another limitation is the inability of sensor to differentiate between human being and objects interrupting the IR signal”.

1.1.Motivation

In the present day, in which everything seems to be either an electrical or electronic circuit, we see importance in developing complex circuits to have a higher standard of living. This has resulted in Automation playing a major role in our day-to-day life. Furthermore, it has become necessary to employ ways to be safe because of the global pandemic which has endangered a lot of lives. This project helps in maintaining the crowd especially in crowded areas where chances of getting infected can be avoided. Electricity, a valuable resource, can be saved if used appropriately making use of what we have its full potential. Security is another major factor that has affected most of our lives. The thought of being safe reduces anxiety and other mental issues which greatly affect our behavior. Hence all of these factors have been taken into consideration while designing and constructing this project.[7]

1.2 Existing Method

The existing scheme includes four main sections and circuits. These include the detection section (IR Sensor

circuit), microcontroller section, alerting section (LCD), and power supply circuit. The block diagram is displayed in Figure 1.

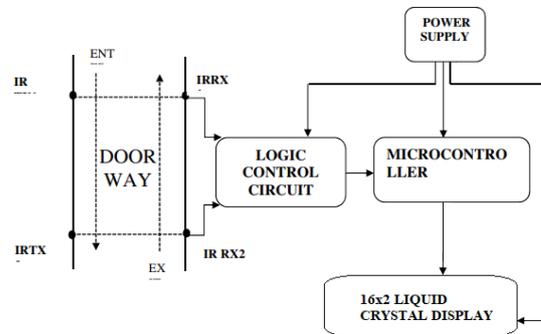
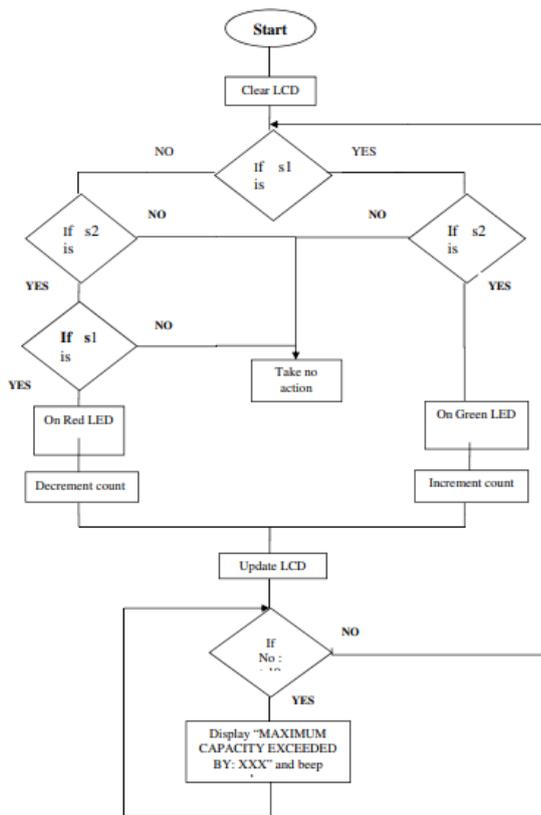


Figure 1 : Block Diagram of the Existing System

Source: <https://core.ac.uk/pdf/234645128.pdf>

The 2 pair of infrared (IR) which consist of a transmitter (TX) and a receiver (RX) is mounted face to face across the doorway. Both sensors are positioned at the entrance with the distance apart. This means upon the approach of a visitor the installed 2-pair sensors are triggered by the obstruction (direct incidence). The direction of the visitor is determined by which sensor is obstructed first before the other sensor follows. If sensor 1 is interrupted first before sensor 2 is interrupted, it indicates that the visitor is entering. The visitor exits the premises by interrupting the sensor in opposite direction. The output of the receiver circuit sends high or low signals in a form of voltage to the microcontroller[6]

The programmed microcontroller follows the set of instructions (C language) written on it. The tally computation (addition and subtraction) is done when it receives low signals from the two IR receivers. It is after this command, which the microcontroller is made to send control signals to the other I/O devices. The microcontroller also sends a data signal to the LCD to visually display the exact number of visitors remaining in the building. The Flowchart is as presented in Figure 2.



Source: <https://core.ac.uk/pdf/234645128.pdf>

1.3 Proposed Approach

The planned approach has five main sections and circuits. These include the power supply section, microcontroller section, sensor section (IR Sensors and Proximity Sensor), Alert section (LCD and buzzer), and Electrical devices (Bulb or Fan) to demonstrate light automation. The block diagram is displayed in Figure 3.

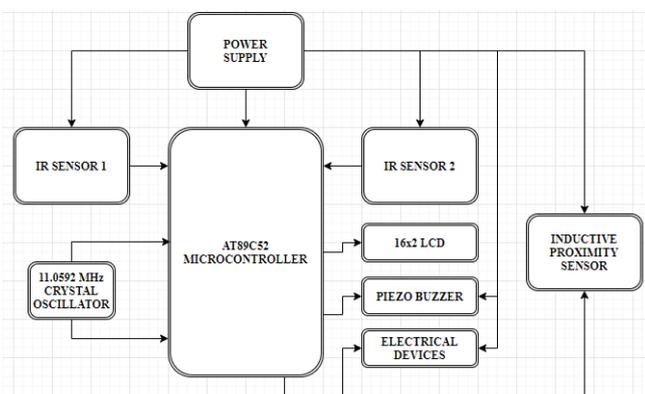


Figure 3 : Block Diagram of the Proposed System

Now when a transition ensues, i.e. a logic low level is acknowledged at port P1.0 then on P1.1, the compiler perceives this as a disruption to sense the passage of a person or an object between the IR LED and the phototransistor. As per the program, the count value is increased implying that someone has entered the building and this count value is exhibited on the LCD. Similarly, if a transition takes place,

i.e., a logic low level is received at port P1.1 then on P1.0, the compiler sees this as an interruption to sense the passage of a person or an object between the IR LED and the phototransistor. As per the program, the count value is decreased implying that someone has left the building and this value count is displayed on the LCD.

If the count value is greater than 1 i.e., if there are one or more people in the room, the electrical device starts working indicating the Home automation feature which could be accessed by using a relay to run real-time appliances like a light bulb or a fan.

The Proximity Sensor detects any metal object, if found, alerts through the buzzer and indicates a message 'METAL IS DETECTED' on the LCD Screen..

1.3.1 Power Supply Section

There are many types of power supply. Most are designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices.[5] A power supply can be divided into a series of blocks, each performing a certain function. As we are altering 230V AC into a 5V DC, first we require a *step-down transformer* to decrease such high voltage. *Rectification* is the method of eradicating the negative part of the Alternate Current (AC), hence producing the partial DC.[8] This can be accomplished by means of 4 diodes (*Bridge Rectifier*). The output subsequent to the Rectification process is not the appropriate DC, it is an oscillation output and has excessive ripple factor. Such a pulsating output is not required; hence we make usage of a Capacitor. This is done to implement *Smoothing/Filtration*. A *voltage regulator IC 7805* is used to deliver a regulated 5V DC. Input voltage ought to be 2 volts additional to that of the rated output voltage for the proper working of IC, which means at least 7V is needed, even though it can operate in an input voltage range of 7-20V. A typical block diagram of the 5V power supply is shown in Figure 4.

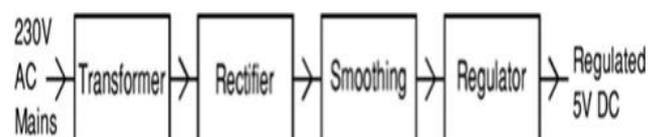


Figure 4 : Typical Block Diagram of the Power Supply

Source: <https://slideplayer.com/slide/9230653/>

1) Results & Discussions:

When the system is powered on, the compiler initializes the stack pointer and all other variables. It then scans the input ports (Port P1.0 first then Port P1.1). In the meantime, when there is no interruption between the IR LED and the phototransistor of the first sensor pair, the output of the phototransistor is always at high voltage.

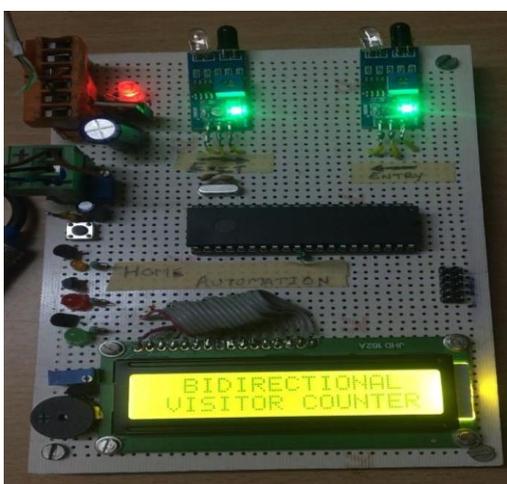
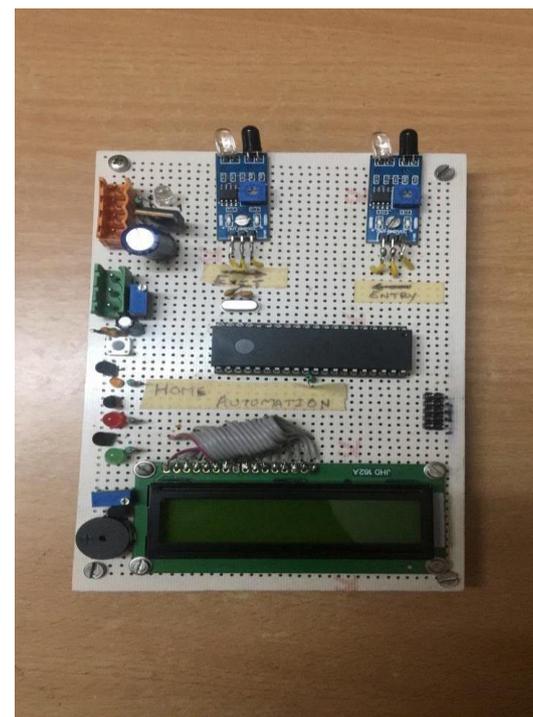
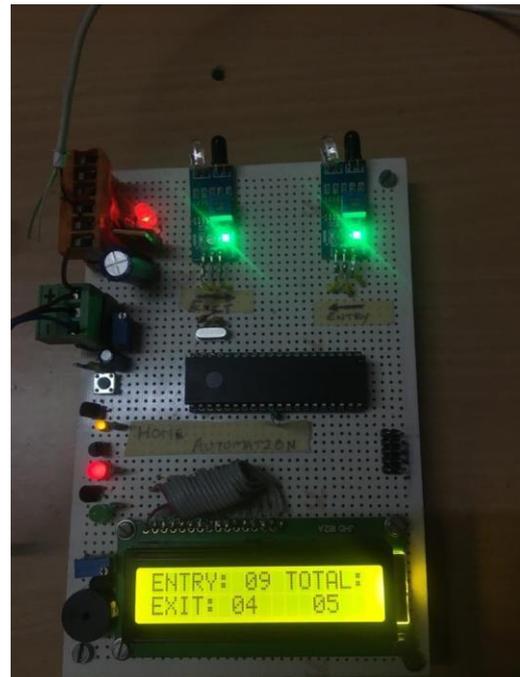
Now when a changeover takes place, i.e. a logic low level is received at port P1.0 then on P1.1, the compiler perceives this as a disruption to sense the passage of a person or an object between the IR LED and the phototransistor. As per the program, the count value is increased implying that someone has entered the building and this count value is exhibited on the LCD. Similarly, if a changeover takes place, i.e. a logic low level is received at port P1.1 then on P1.0, the compiler sees this as an interruption to sense the passage of a person or an object between the IR LED and the phototransistor. As per the program, the count value is decreased implying that someone has left the building and this value count is displayed on the LCD.[9]

If the count value is larger than 1 i.e., if there are one or more people in the room, the electrical device starts working indicating the Home automation feature which could be accessed by using a relay to run real-time appliances like a light bulb or a fan. If the count value is a lesser amount than 5, a green LED glows indicating it is safe to enter the room. If the count exceeds 5, a red LED glows indicating that the room is getting crowded. If the count reaches the value 10, a warning is given through the buzzer indicating that too many people have entered the room.[10]

The Proximity Sensor detects any metal object, if found, alerts through the buzzer and indicates a message

‘METAL IS DETECTED’ on the LCD Screen.

A reset button is also implemented to initialize the circuit to state 1 or the initial state.



3. CONCLUSIONS

This project describes an easy model for visitor counter without human intervention. By using the IR sensors, the IR receiver can detect the IR rays from the IR transmitter, then microcontroller increments or decrements the count of visitors. Circuit is implemented in the Kiel software and implemented on the microcontroller. The performance has been verified both in software and hardware design. The total circuit is completely verified and is functional. It can be concluded that the design implemented in the present work provide portability,

flexibility, and the data transmission is also completed with low power consumption.

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