BI-DIRECTIONAL COUNTER USING 8051

A Mini Project Report submitted to the Microprocessor lab

Submitted by

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ABSTRACT

In today's world, the increasing importance of data-driven decision-making has led to worldwide usage of smart technologies in every field of work. Many sectors like businesses and public areas, are using technically advanced machines to do the work. One of such technology is the bidirectional visitor counter. Bidirectional visitor counter is a tool that keeps the count of how many people come inside and go out of a place at any given amount of time. This device is very useful for places with frequent visitors and large crowd.

The methodology used in bidirectional visitor counter requires a union of hardware and software components designed to count people entering and leaving a particular place accurately. The microcontroller is configured in a way that it differentiates between the entry and exit established by sensor activities. Upon a person's entry, the entry sensor is activated while the exit sensor comes into play as the person exits. The microcontroller keeps distant tallies for both entries and exists, enabling it to calculate the overall visitor count by subtracting the exit count from the entry count.

The main result of bidirectional visitor counter is the accurate count of people entering and existing an area. It provides real-time data on the number of people in a place. By examining the data over time, the counter helps identify peak hours when there is a higher influx of visitors. The counter's ability to monitor and manage occupancy levels is crucial, especially in public spaces during events. It helps to manage overcrowding, ensuring a safer and more comfortable environment.

The bidirectional counter uses data analysis capabilities which is used for important conclusions that have scope for businesses. This counter offers strategic insights for marketing and safety. Businesses can use the counter to identify popular entry points, which can be useful for the effectiveness of promotions during specific times. This counter is helpful in resolution of potential issues such as overcrowding which can lead to security threat. Software used in the making of bidirectional visitor counter are proteus and Kiel vision 5.

Contents

CHAPTER 1

INTRODUCTION

1.1 *Introduction*

In this chapter, the current status of bidirectional visitor counter is going to be explored. Furthermore, both the primary and supplementary application of these counters with present standing and diverse uses will be discussed. Additionally, there will be emphasis on importance of the results obtained by these counters in workplace environments. Examination of results will give a brief idea how bidirectional visitor counter increases efficiency and strategic decision-making.

1.2 *Brief present-day scenario with regard to the work area*

In present-day scenario, bidirectional visitor counters have become a vital tool in various areas where real-time crowd controlling is required. Businesses, public areas, and security systems depend on these counters to organize their spaces. With advancement in technology these counters have gotten more efficient in giving accurate details. Nowadays, these counters are widely used for security purposes in malls, museums, airports etc. These counters make smart decisions with data, organize spaces better, and keep everyone safe, contributing to the overall efficiency.

1.3 *Objective of the work*

The primary use of bidirectional visitor counter is to precisely count and record the movement of people entering and exiting a particular area. The data obtained by bidirectional counter helps to manage security measures by providing real-time information on individuals entering and leaving specific areas. Furthermore, these counter can be used by businesses to figure out the busiest time for their market which will help them to maintain their marketplace better by providing smooth services and well-staffed workplace.

1.4 *Target specifications*

The results obtained from bidirectional visitor counter serve as a foundation for data-driven decision-making. These counters helps in enhancing customer experience, detecting anomaly at a specific area and keeping it safe. It helps in managing occupancy levels in public places and areas with regulatory requirements. The results obtained by bidirectional visitor counter assist in allocating staff and resources more effectively, ensuring that the right level of support is provided during peak times.

CHAPTER 2

BACKGROUND THEORY

2.1 *Introduction*

This chapter is all about bidirectional visitor counters which are advanced tools that keep track of people moving in and out of a place. Additionally, it will shed light on how important and useful these counters are. Imagine them as eyes, watching who comes and goes, and calculating about it in real-time.

2.2 *Theoretical discussions*

The theoretical discussions involves an exploration of the sensor technologies employed, the directional analysis principles, real-time data processing algorithms, and the integration with central systems.

a) Sensor technology – Bidirectional visitor counters use infrared sensors. These sensors detect the presence and movement of individuals, enabling the system to track entries and exits accurately.
b) Directional analysis – The counters uses directional analysis to determine the direction of movement whether someone is entering or exiting. This can be done by interpreting the sequence and order in which the sensors are activated. The system differentiates between the two directions based on observed pattern.
c) Real- Time Data processing – Bidirectional counters operate in real-time, processing data quickly and efficiently. This involves the use of algorithms that analyse the information from the sensors instantly, providing up-to-the-minute insights into the number of people in a specific area.

2.3 *General Analysis*

These counters encompasses their role in data-driven decision-making, optimizing operational efficiency, enhancing customer experiences, ensuring security through anomaly detection, managing occupancy levels, and adapting to dynamic conditions. The general analysis provides insights into how bidirectional counters contribute to diverse sectors and their overall impact on creating safer, more efficient environments.

2.4 *Conclusions*

The bidirectional visitor counters are like smart helpers. These counters are versatile. They help in workplaces, making things run smoothly and safely. They assist in public places too, managing crowds and keeping everyone comfortable. These counters helpful for using resources wisely, keep things efficient, and make decisions based on real data.

CHAPTER 3

METHODOLOGY

3.1 *Introduction*

This chapter includes detailed information on working of the circuit of bidirectional visitor counter. Additionally, Circuit layout and block diagrams will be introduced. Components specifications and their usage in circuit is explained. A detailed exploration of the intricacies involved in the functionality of the circuit is presented. The chapter encompasses comprehensive explanations of circuit layouts and block diagrams, shedding light on the systematic integration of components.

3.2 *Methodology*

The circuit works on the principle of IR sensing. Infrared Sensors are devices that work with Infrared Light Source and a Photo Detector like a Photo Diode that act as a Transmitter and Receiver respectively. Two sets of these sensor pairs are positioned at two ends of the entrance to a room. They are set up so that the IR LED and Photo Diode are facing each other, with a gap in between.

Under normal conditions, when there is no obstacle or person passing through the entrance, the IR light emitted by the IR LED does not reach the Photo Diode because it is a reflective type IR sensor. Therefore, the Photo Diode does not receive the IR light, and its output remains at a logic LOW signal. When a person or object crosses the path between the two sensor pairs, it interrupts the flow of IR light from the IR LED to the Photo Diode. As a result, the Photo Diode starts receiving the IR light and begins to conduct. This change in the IR light reception causes the output of the Photo Diode to transition to a logic HIGH signal.

The outputs from each sensor pair are connected to a microcontroller. The microcontroller continuously monitors the status of these outputs. When the microcontroller detects a transition from LOW to HIGH on the output of a sensor pair, it counts this as an event. The microcontroller can be programmed to increase or decrease a count based on the direction in which the interruption occurred. The result obtained is displayed on LCD display.

3.2.1 Block Diagram:

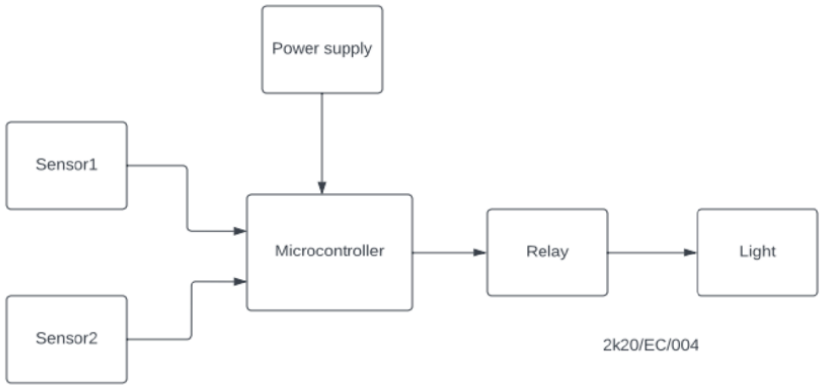

Figure 3.1

3.2.2 Circuit Layout:

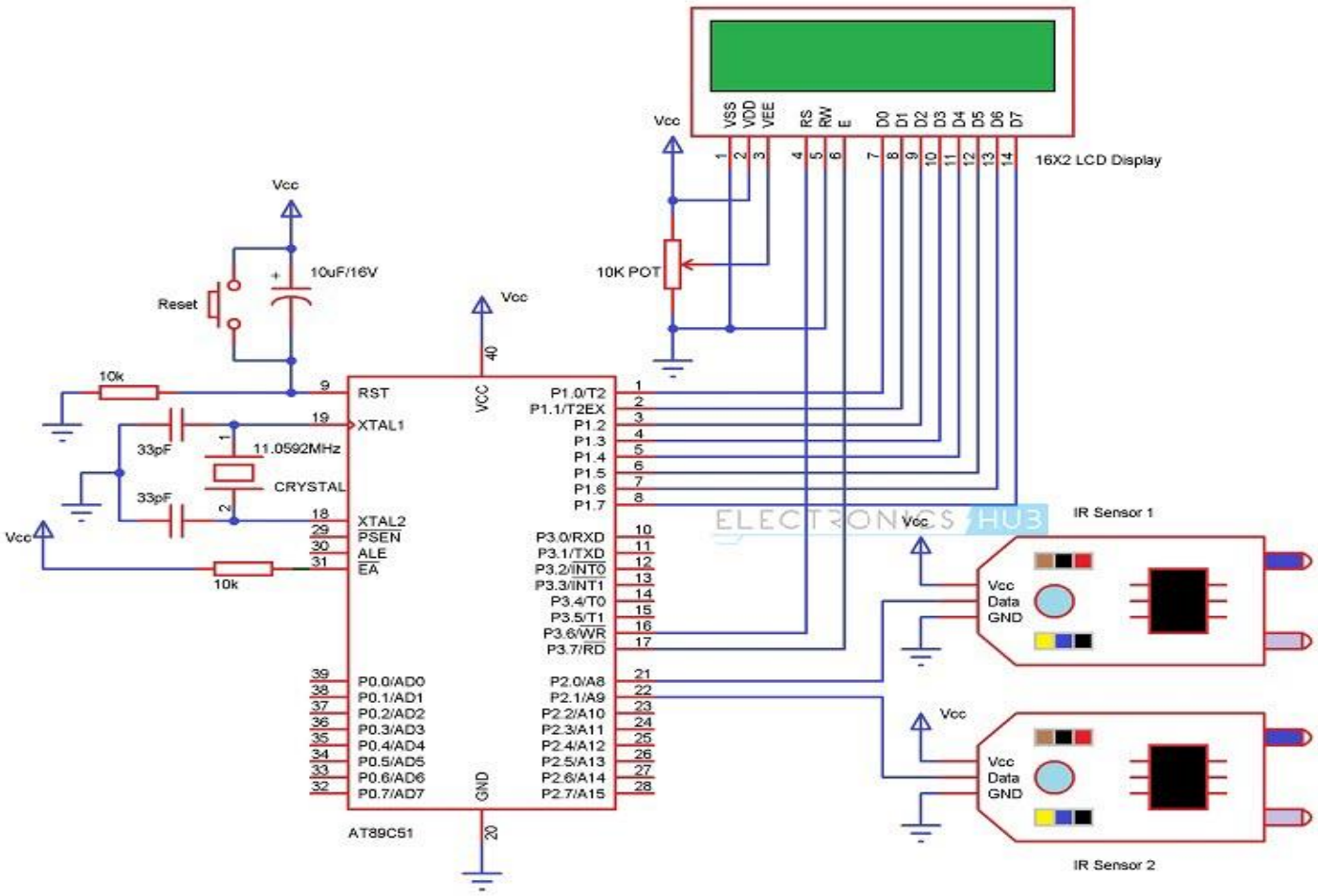

Figure 3.2

3.2.3 Components specifications:

1. 8051 microcontroller – processing speed, memory, input/output pins
2. 10µF electrolytic capacitor – signal conditioning component
3. 10kΩ resistors – signal conditioning component
4. 33pico-farad electrolytic capacitor - signal conditioning component
5. 16x2 LCD display – Digit size, visibility, refresh rate
6. 10kΩ potentiometer – voltage control, tuning circuits
7. IR sensors LM393 – wavelength sensitivity, detection range, response time

3.2.4 Justification for component selection:

1. 8051 microcontroller: Microcontroller will be the core of the system, responsible for processing inputs, managing the count, and controlling the display.
2. Infrared Sensors LM393: These sensors can be used to detect the presence of a person entering or leaving. These are placed on either side of a entrance.
3. 16x2 Display: This device displays the current count.
4. Resistors: This component is used for tuning the circuit and also act as voltage divider.
5. Capacitors: This component is used for smoothening out voltage fluctuations.
6. Potentiometer: This device is helpful in changing voltage when required.

3.3 *Tools used*

Software used

1. Proteus Simulation Software
2. Kiel Vision 5

3.3.1 Reference data sheet:

Refer to the '8051 Microcontroller Datasheet' for detailed information on the microcontroller's pin configuration, features, and electrical characteristics. Figure 3.3 in the datasheet provides additional visual insights into the microcontroller's specifications and can be particularly helpful for understanding specific aspects of its design and functionality.

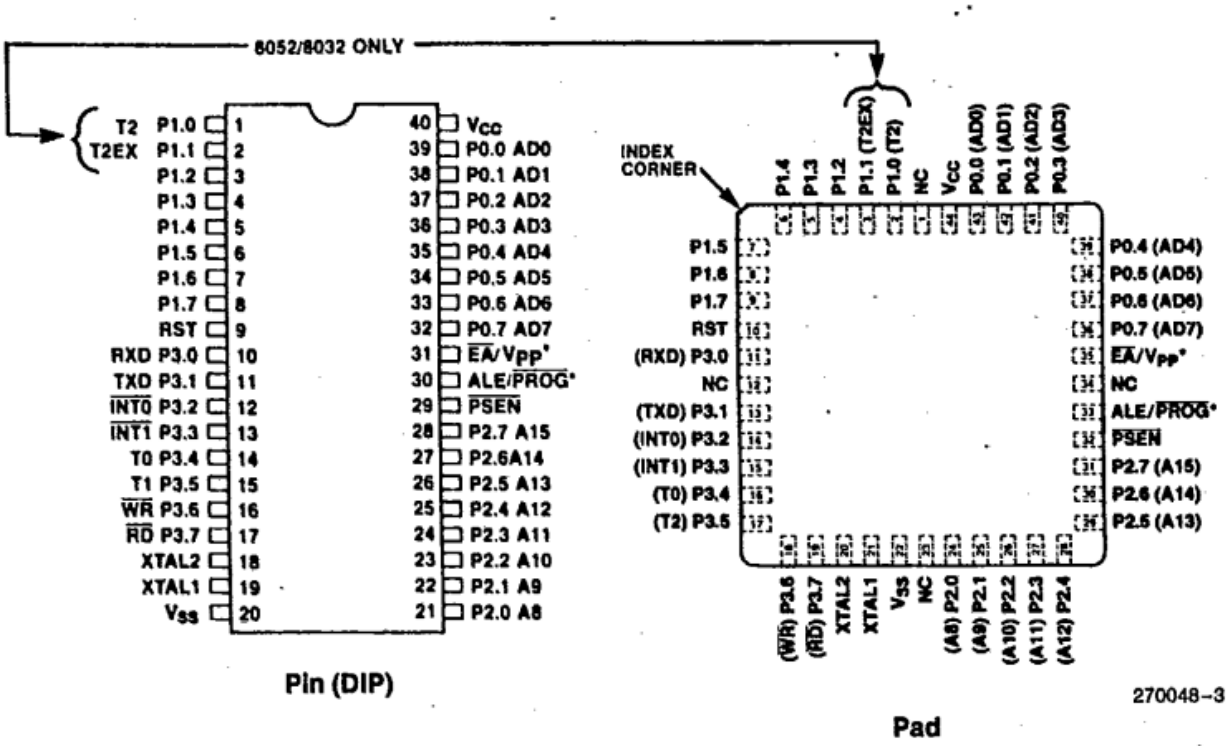

Figure 3.3

3.4 *Conclusion*

This chapter provides a comprehensive overview of the methodology, tools, and component selection. The development process for the bidirectional visitor counter centred on the integration of key components: infrared sensors, an 8051 microcontroller, and a display unit. Circuit layout is crafted to visually articulate the connections. component specifications, including infrared sensor models, 8051 microcontroller details, and display unit characteristics, were meticulously considered.

CHAPTER 4

RESULT ANALYSIS

4.1 *Introduction*

Presenting the findings derived from the bidirectional counter integrated with the 8051 microcontroller. This segment unveils the results of the implementation, providing insights into the counter's operational efficiency, precision, and its ability to manage various counting scenarios. Through a thorough analysis of the obtained results, we gain a comprehensive understanding of the practical implications and potential applications of this bidirectional counting solution within the realms of embedded systems and electronic applications.

4.2 *Simulation*

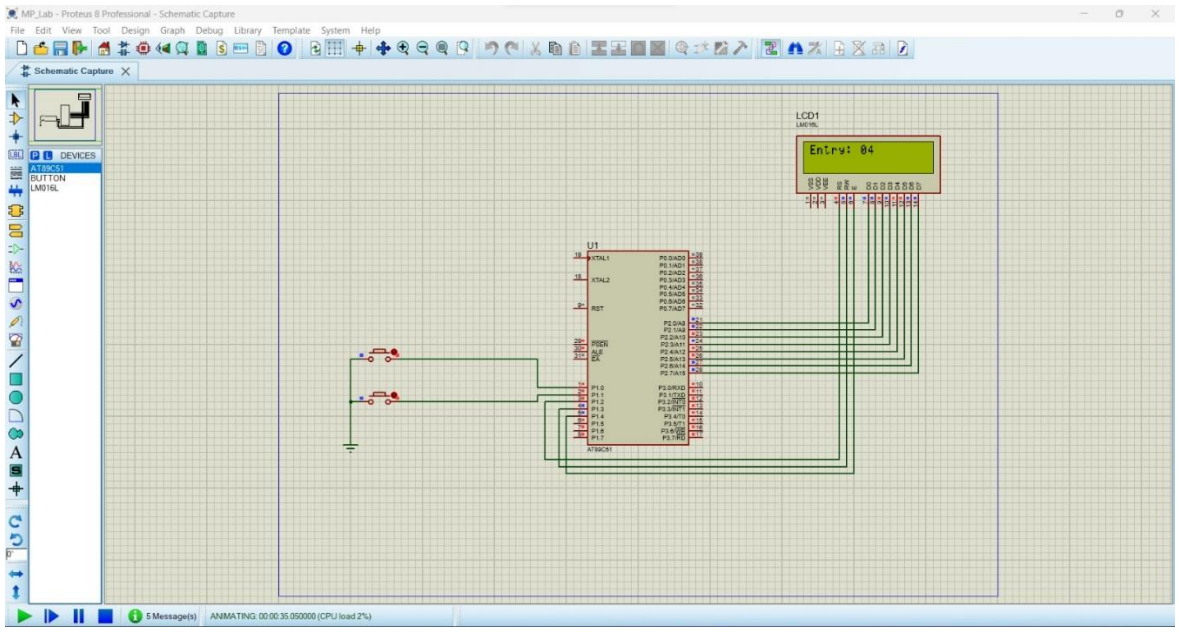

Figure 4.1

In this simulation switches except for the IR sensors has been used because LIRC library was causing difficulty to being imported in the proteus software. Apart from this our simulation was giving expected output as per our problem statement.

4.3 *Significance of the result obtained*

The result obtained from the hardware part of the project is completely dependent on the accuracy of the IR sensors. In our project, the use of budget-friendly IR sensors occasionally leads to simultaneous detection by both sensors, resulting in a failure to produce the expected output in such instances.

4.4 *Conclusion*

In conclusion, our project integrating the bidirectional counter with the 8051 microcontroller has proven to be a valuable venture in electronic systems. Despite occasional challenges with simultaneous object detection due to the use of low-budget IR sensors, the overall performance and adaptability of the bidirectional counter showcase its significance. The insights gained from this project contribute to the broader understanding of implementing cost-effective counting solutions, offering valuable lessons for future endeavours in embedded systems and applications.

CHAPTER 5

CONCLUSION AND FUTURE SCOPE OF WORK

5.1 *Brief summary of the work*

The goal of the Bidirectional Visitor Counter using 8051 Microcontroller project is to develop a system capable of keeping track of people in particular area. This project aims to manage crowd in public places such as airports, malls, hospitals, cinema halls etc where safety is a major issue and not maintaining proper protocol can lead to a major threat to people. The use of an 8051 Microcontroller enables real-time monitoring which keeps the security system at that particular area updated on the current situation. In summary, the project aims to use technology to develop a practical solution for dealing with incidents in a variety of settings.

The work methodology for the Bidirectional Visitor Counter project follows a systematic approach, beginning with a clear definition of project objectives and identification of the target environment, such as a mall. Components selection involves careful research to choose suitable elements, including the infrared sensors, 8051 Microcontroller, and LCD display. The circuit design is meticulously planned, considering signal conditioning and layout.

5.2 *Conclusions*

The counter system demonstrates reliability in its ability to consistently detect and count visitors. The chosen infrared sensors, strategically placed and calibrated, contribute to the accuracy of the counting mechanism. Continuous testing and validation have ensured the system's dependability in real-world scenarios. The implementation's user interface, manifested through the display unit, provides a straightforward and accessible means of interpreting visitor data. The simplicity of the design ensures ease of use and interpretation for individuals monitoring the system.

The bidirectional visitor counter, built upon the 8051 microcontroller and infrared sensor technology, effectively counts and differentiates between incoming and outgoing individuals. The display unit accurately reflects real-time visitor counts, providing a tangible output for monitoring foot traffic.

5.3 *Future scope of work*

The present implementation is giving accurate results but it is essential to know potential limitations. Factors such as environmental conditions, lighting variations, and the need for occasional recalibration can influence the counters performance. Future work could focus on these limitations, optimizing power consumption, and including features such as wireless data transmission for remote monitoring. We also tried to inculcate

temperature sensor so that our project only senses people and not other objects. But temperature sensor of any kind is not compatible with 8051 microcontroller. We could have done this if we were allowed to use Arduino, Raspberry pi or some other controller for this project.

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