Door Movement Alert System

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ABSTRACT

Accidents could happen anywhere at any time in shipping industries. Over the years shipping companies have been investing great effort into reducing the amount of incidents onboard ship. No matter the severity of the injury, incidents are still bad and need to be avoided. One of the most common incidents onboard happen during opening or closing of the door onboard ship which results in finger pinch and door accidentally hitting the person on the other side. The objective of this journal is to describe a simple design with application of microcontrollers based system that can be readily adapted into the current vessels. The installation is simple and can be carried out by the ship's crew. The simulation for this design is simulated using Proteus software and the coding was carried out using MBLab. The focus of the project is to alert crew members of person movement near the door to increase awareness and prevent incidents. The PIR sensor will detect infrared energy emitted by human body and send the signal to the MCU to indicate there is activity at the vicinity of the door. The MCU will activate the LED located at the top of the door. This will give awareness to the crew to take extra precaution on opening the door.

KEY WORDS: *PIC Microcontroller, PIR Sensor, MCU, Door Buzzer*

NOMENCLATURE

LED	Light Emitting Diode
PIR	Passive Infrared Sensor
PIC	Peripheral Interface Controller
MCU	Microcontroller Unit
ZETO	Zero Tolerance
DIY	Do It Yourself

1.0 INTRODUCTION

Shipping companies are heavily emphasizing in the importance of safety at work. Although they all have different names for their theme such as 'ZETO' [1], their main purpose is to increase safety awareness among seafarers. Compared to people working on shore, seafarers have limited access to medical care.
Ships are a moving vessel that constantly undergoes rolling and pitching and this condition increases chances of injures. Door related injuries are very common onboard vessel. This incidents happen mostly due to lack of awareness that another person could be on the other side of the door and this cause a lot of money to companies in lawsuit [2].

1.1 Similar System

The system is similar to the automatic sliding door found in places such as shopping mall and hospitals. The system uses PIR that detect infrared energy from the human body and sends signal to the controller. This controller will operate the motor to open or close the sliding door [3].

2.0 METHODOLOGY

The PIR will always be in operation to detect infrared energy from a particular distance approximately 1 meter. If infrared energy is detected, PIR will send signal to the MCU. The MCU in return will give output to the LED which indicates there is crew member near the door. The idea of using LED instead of buzzer is more practical since this installation will be carried out in the accommodation doors. Onboard ship, the general practice is watch keeping whereby ship's crew work on shifts and have different rest hours. Hence using LED at the doors will not cause sound disturbance to people who are resting. The components in the system is relatively simple and inexpensive. It can be easily acquired at any electrical shops in case of repair or maintenance.

2.1 Component

The system is composed of (1) PIC16F877A. This microcontroller has 40-pins [4]. The monitoring component is the (2) PIR which will detect infrared energy from a particular distance. A (3) LED will be installed at the door which will be lighted up by the microcontroller. (4) Crystals are used in the microcontroller to

provide a stable reference oscillation signal and used as input reference clock [5].

2.2 Operation

The concept of this system operation can be defined as below:

- The LED lights up when person is near the door
- The LED will turn off when no infrared energy detected for more than 5 seconds

Table 1, shows the logic of the operations.

Table 1: Truth Table

Input port	Output port
RCO/T1OSO/T1CKI, PIR	RB2, LED
0	OFF
1	ON

2.3 Microcontrollers

This PIC 16F877A (Figure 1) is the central unit that control the system. It receives input and sends output as per the programming. It does not require additional components to function and only required 5V power input. This MCU can be used for many DIY projects and can replace Arduino module which is more complicated in general [6].

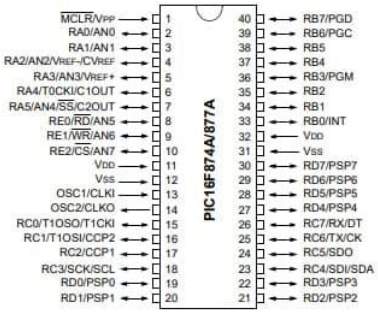

Figure 1: PIC 16F877A

2.4 Software

The 'MBLab' is used for the programming and compiling of the HEX file coding. The HEX file will be dumped into the microcontroller. A device called PIC Kit 3 is used to dump the HEX file to the microcontroller. PIC Kit 3 is a hassle-free and relatively cheap to use.

2.5 Flow Chart

This system works in sensing person movement by infrared energy. Once the energy is detected, the PIR sends input to the MCU which will decide to activate the LED to indicate presence of human near the door (Figure 2).

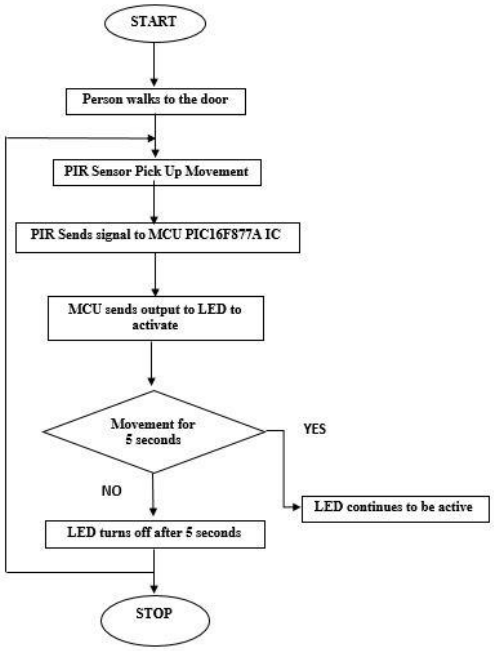

Figure 2: Flowchart of the system

2.6 Circuit

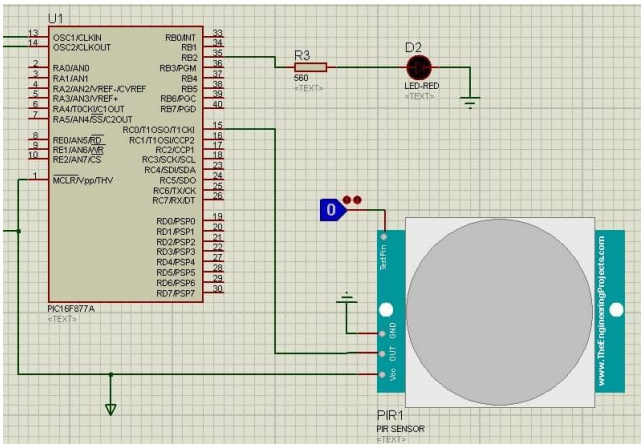

Figure 3: Input and Output

In figure 3 shown above, the input from the PIR is connected to Port C. The output from the MCU is connected to the LED using Port B.

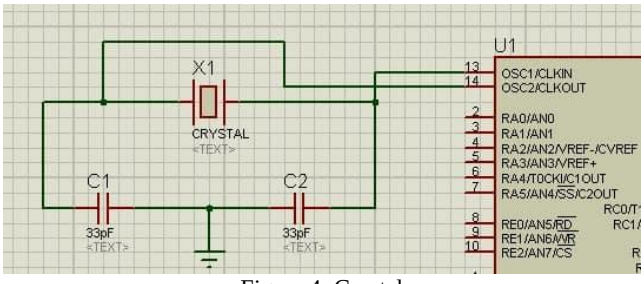

Figure 4: Crystal

In figure 4 shown above, crystal is installed to the MCU to set delay time after the PIR stops sending input to the MCU.

3.0 CIRCUIT DESIGN SIMULATION

By using Proteus v7.6, the circuit is simulated in the software in order to check the functionality. In the original software library, the PIR component is not available which needed to be externally added [7]. Since Proteus cannot simulate presence of infrared energy to the PIR, therefore a logic toggle is added to the PIR to give 1 or 0 signal to the MCU. The coding is compiled by using MBLab. Once the Hex file is extracted from the MPLab, it is dumped into the PIC16F877A using PIC Kit 3. The circuit that was tested is shown in Figure 3. The MCU input from the PIR is connected to Pin RC0. The output to the LED from the MCU is connected the RD2 [8].

4.0 RECOMMENDATIONS

Using this system, there is room for further improvement in terms of safety aspect. The additional ports which are available in the MCU can be utilized to add more feature. Integrating the doors locking and unlocking mechanism to the MCU which operates in the system, the doors will be electronically locked when the LED activates. This will provide additional safety since the door cannot be opened when there is people at both side of the door. In case of emergency, this system should be able to be bypassed from the wheelhouse by the Master authority.

5.0 CONCLUSION

This system is designed with safety in mind as priority and minimizing injury that can be prevented with awareness to prevent loss time injury that will affect the operation of the vessel.
This system has many potential which can be expanded further than shipping industry. It can be implemented in shore industry such as manufacturing factories and research labs. The PIR can be used in many applications. It is already being used in homes for detecting human presence and switching on lights.

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