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Advance Tunnel Alert System

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ABSTRACT

This project is to design and fabricate an alarm system for tunnel application by using a PIC16F877 as the central controlling unit. The purpose of the alarm system is to save human live in case of tunnel collapsing. The system is designed to detect any angle changes at the walls of tunnels, and give an early warning of the happening of failure of tunnel. It has done with the application of angle sensors that are able to sense the changing of angles of walls.

Keywords: tunnel, alert system, detect

Introduction

In many cases, the success of a project that initiates technological advances is ultimately measured in terms of its contribution to the quality of life, to society, the economy, or the environment. The technologist is therefore required to maintain a broader perspective than just technological concerns. Sensitivity to and consideration for the community, environment, and general public begin long before the design phase and remain a priority throughout the construction phase as well as during project operation. Soil erosions and landslides in tunnel are unquestionably the most feared risk which could happen to a tunnel operator, not only in terms of the potential for catastrophic damage, but in terms of the risk of life. Considerations of passenger safety drove almost all of the major decisions about the design and operation of the project. It was recognized from the beginning that a continuous tunnel would require special measures to ensure an adequate level of safety, the number of emergency escape routes is increased, an advantage during both construction and operation.

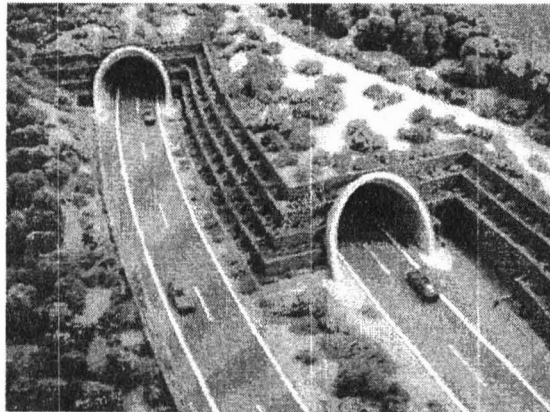


Fig. 1: Tunnel Systems

This project is to design and construct an alarm system in tunnels for the security of the workers. The project is designed by using microcontroller. There are a few things that need to be emphasized in order to achieve the objectives of the project. This includes signal conditioning, data acquisition for instrumentation and measurement, hardware and software of microcontroller. The hardware that is used for the system includes angle sensors, alarm, spotlight, warning light and microcontroller. The system is designed to detect any angle changes at the walls of tunnels, and give an early warning of the happening of failure of tunnel. It is done with the application of angle sensors that are able to sense the changing of angles of walls.

Objectives

The objectives come out with a project based on security system for tunnel application that is more reliable and effective in protecting human lives and properties in the event of soil erosions or landslides in tunnels. Due to the

safety considerations built in to system design and operation, the main objectives of the project are:

- (i) construct and design a project based on security system for tunnel application that is more reliable and effective in protecting human lives and properties in the event of soil erosions or landslides in tunnels.
- (ii) design and build a system that will give an early alarm warning to all of the users in tunnels about the occurring of landslides or soil erosion in tunnels.
- (iii) measure the angle changes of the walls in tunnels, by using appropriate angle sensors in order to trigger PIC microcontroller.

Specification of Project

Basically, the project is divided into two main parts, the hardware part and the software part. In term of hardware, the type of sensors used in this project is angle sensors, where the operation of the project depends on the changing of angles in tunnels. There are rows of angle sensors set along the walls of tunnels, which are divided into two types of angle levels, the dangerous level and the critical level. The angles use the sea level as reference as zero angle, and the angle of the sensors can be set manually according to the requirement. For the different angle level sensing, the alarm system will perform different functions. When the angle sensor detect the changing of the angle to dangerous level, which is 5° in this project, the alarm and the spotlight will be switched on. On the other hand, when the changing of angle approaches critical level, which is 10° in this project, the alarm light will be switched on. Hence, the road users or the workers in tunnels will be able to realize about the dangerous, and run away immediately for their safety. The function of the spotlight is to brighten the way along tunnels. While the function of the alarm is to let the workers in further distance to alert about the dangerous. In the software part, the overall system is controlled by PIC microcontroller. The PIC microcontroller is used to control every functions of the project, from the alarm, spotlight until warning light automatically after the sensor trigger the PIC microcontroller, so that each of them can perform their task orderly and well. The program developed for the PIC microcontroller using assembly language.

Methodology

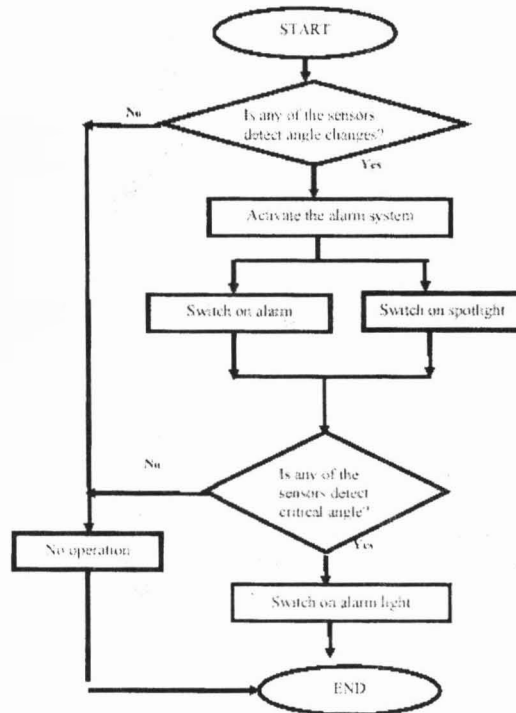


Fig. 2: Project Flow Chart

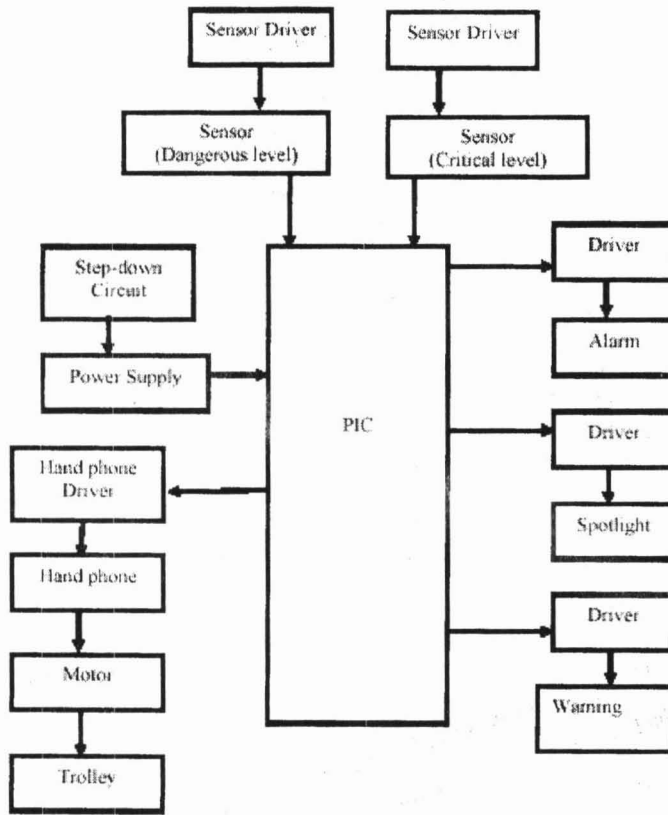


Fig. 3: Connection between PIC and External Hardware

Prototype

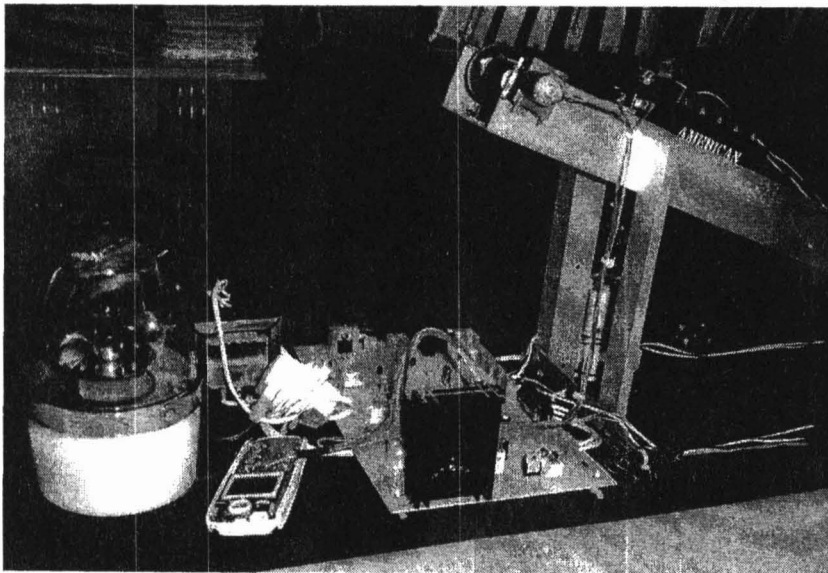


Fig. 4: Actual Prototype

For this alarm system, the angle sensor will detect the changes of the angle of the wall in tunnels, in certain degrees. The sensors will detect the changes of the angles according to the movement of the soil in the tunnels. Two levels of angle are set to the sensors that are dangerous level (5°) and critical angle (10°). Any of the sensors will be activated once it detects these changes of angles. When the sensor is activated for the dangerous level, the alarm and the spotlights will be turned on. With the alarms turn on, the victims in further distance can be able to receive the warning sound that landslide or soil erosion is happening. Apart from that, with the spotlights turned on, the condition in the tunnels will be brightened so that the victims inside the tunnels can be able to run away for their safety. On the other hand, if the angles sensor is activated for the critical level, the alarm light will be turned on, as well as the alarm and the spotlight. This is to give warning to the victims inside the tunnel that the landslide or the soil erosion has come to an alarming stage. They need to take further action, for instance bring along their belongings and run away faster for their safety.

Conclusion

More often than not, these accidents happen without expectation, especially during raining days. This project play an extremely important part to give early alert or early alarm warning to the users, includes the workers in tunnel when there is any symptoms of happening landslides in tunnels. This is important to ensure that the victims realize about the dangerous and will then run away as fast as possible for their safety. On the other hand, the project provides not only spotlight to brighten the ways along the tunnels, but also alarm and warning light to give higher alert to victims. This is important to ensure the victims in further distance realize about the dangerous as well.

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