



Sensors Application Using PIC16F877A Microcontroller

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To cite this article:

Huthaifa Ahmad Al-Issa, Saed Thuncibat, Mosa Abdessalam, Sensors Application Using PIC16F877A Microcontroller, *American Journal of Remote Sensing*, Vol. 4, No. 3, 2016, pp. 13-18, doi: 10.11648/j.ajrs.20160403.11

Received: June 11, 2016; Accepted: June 27, 2016; Published: July 21, 2016

Abstract: In the 21st century, sensors have become common and part of everyday life. Such as touch-sensitive cell phones, computer monitors, elevator buttons, lamps that automatically dim or brighten, and even cars that park themselves. In addition, there are many applications of sensors that are hidden but control many facets of modern life such as in cars, airplanes, medical imaging, satellite communications and navigation. This research effort examines three sensor types, their data, and how to integrate it with a single microcontroller to accomplish simple tasks – dimming a light, sounding an alarm and showing a temperature rise. Three sensor types were used in this effort. First, an ultrasonic sensor was used to measure the distance from an object. A temperature sensor was used for monitoring temperature change from a human touch. Third, a Light Depending Resistor (LDR) sensor was used to detect different levels of light in a room. The goal of this research was to make a smart device that can be used to solve simple problems. Further applications could be applied to perform tasks such as controlling the temperature of a room or controlling the level of water in a meter. Also, robotics could be improved by providing information about distance to an object. Many applications can be enhanced based on this research.

Keywords: Sensors, Microcontroller, Ultrasonic Sensor, Temperature Sensor, Light Sensor, Robot, Distance Measurement

1. Introduction

In the modern world of the 21st century, sensors are so abundant and widespread that they are commonly taken for granted. Sensors and micro-controllers have been integrated for specific applications such as touch-sensitive cell phones, computer monitors, elevator buttons and lamps which dim or brighten by touching the base. There are also innumerable applications for sensors of which most people are never aware. Applications include cars, machines, aerospace, medicine, manufacturing and so on [1].

Simply put, a sensor is a device for detecting and signaling a changing condition [2]. A sensor (also called detector) is a converter that measures a physical quantity and converts it into a signal which can be read by an observer or by an (today mostly electronic) instrument [3-6]. For example, a mercury-in-glass thermometer responds to the ambient temperature by expansion and contraction of the mercury liquid. This can be read on a calibrated glass tube. A thermocouple converts temperature to an output voltage which can be read by a voltmeter. For accuracy, most sensors

are calibrated against known standards [6-8].

The sensitivity of a sensor indicates how much the sensor's output changes when the measured quantity changes. For instance, if the mercury in a thermometer moves 1 cm when the temperature changes by 1°C, the sensitivity is 1 cm/°C (it is basically the slope $\frac{dy}{dx}$ assuming a linear characteristic). Sensors that measure very small changes must have very high sensitivities [2, 4].

The sensors themselves may also have an impact on what they are measuring. For instance, a room temperature thermometer inserted into a hot cup of liquid will have a cooling effect on the liquid while the liquid heats the thermometer. For this reason, sensors should be designed to have as small an effect as possible on the environment which it is placed. One way to achieve this is to make the sensor small, the smaller the better. This miniaturization often improves the sensor response and may introduce other advantages as well. Technological progress allows more and more sensors to be manufactured on a microscopic scale as micro sensors using Micro Electro Mechanical Systems (MEMS) technology. In most cases, a micro sensor reaches a

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