

IMPORTANCE OF AN EMBEDDED SYSTEM BASED LOW COST UNIVERSAL INTERFACING KIT: AN OVERVIEW

Sukhdev Kushwaha
M.E. Student
Electrical Engineering Department
NITTTR, Chandigarh

Dr. Shimi S.L.
Assistant Professor
Electrical Engineering Department
NITTTR Chandigarh

Abstract—This paper presents the idea of making a low cost educational Universal Kit based on Arduino UNO platform. The kit is intended to be used for teaching and learning in the embedded system laboratory. Here Arduino UNO platform has been preferred because it provides a tool for development of a test bench especially for sensors. Main advantages of Arduino are easy interface and fast processing. This paper shows a review of approaches of using different types of sensors in different situations along with their design and implementations. This paper is a comprehensive study of various research papers and the methodologies used in making of different types of embedded systems using sensors.

Keywords—Sensors, Arduino, Embedded System, Learning Kit.

I. INTRODUCTION

An embedded system is a part of a larger mechanical or electrical system with a dedicated function within. It is a programmed controlling and operating system. In embedded systems sensors are used for detection of changes in a parameter. There are different types of sensors that are mostly used such as Electric current or potential sensor, Heat or Temperature sensor, Proximity sensor etc.

Poonam et al. in [1] have proposed a system for monitoring the room temperature by embedded wireless sensor network prototype. This method is useful for fire rescue management. It gives the freedom to Android users to monitor room temperature remotely and thus it provides the better way for fire controlling.



Fig. 1.1 Architecture of Remote Temperature Monitoring Application

José David Filoteo-Razo et al. in [2] have presented the method and design to detect color changes by optical

sensor in fruit to measure fruit ripeness in industrial and agricultural applications. The system photo detectors, a power source, plastic optic fiber (POF) and LED RGB array. Power emission of diodes has been controlled by graphic interface of Lab view by mixing the colors digitally at different intensities.

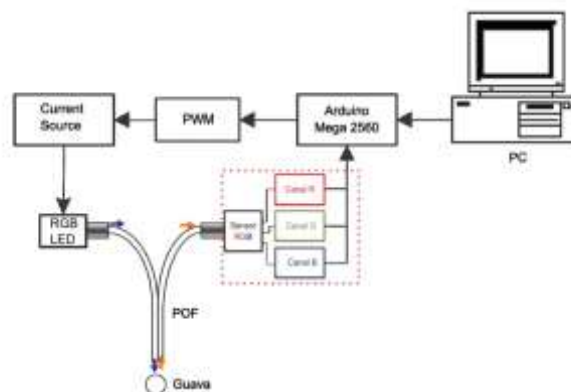


Fig. 1.2 Modular diagram of the device for the color sensor for a sample project

Pema Chodon et al. in [3] have proposed a security system based on graphic interface which saves the memory space and power consumption of the recording system.

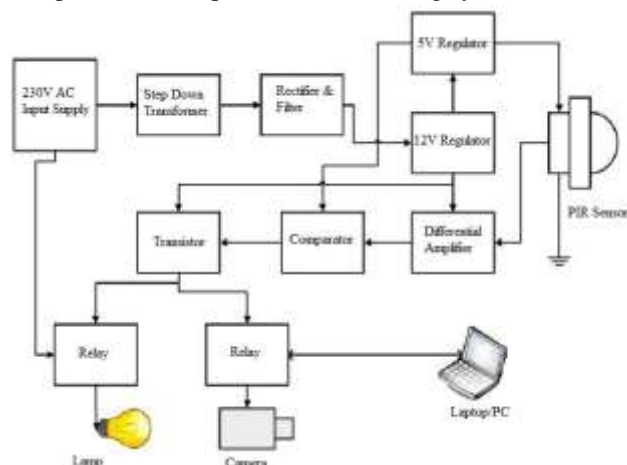


Fig. 1.3 Block diagram of the proposed system

When a warm blooded object comes in range of Passive Infrared Radiation Sensor it detects the radiation change and in turn it will change in the voltage generated which is amplified and is used to turn ON the lighting system and webcam through a relay.

SitiAsmah Daud et al. in [4] have presented the use of infrared sensor planted in a sensor rig to find the distance of the object placed at the centre of the plate. Arduino microcontroller has been used as controller and the data received by the sensor rig is saved in a text file using CoolTerm terminal application. Data obtained from the IR sensors is then processed by using MATLAB software to reconstruct the image.

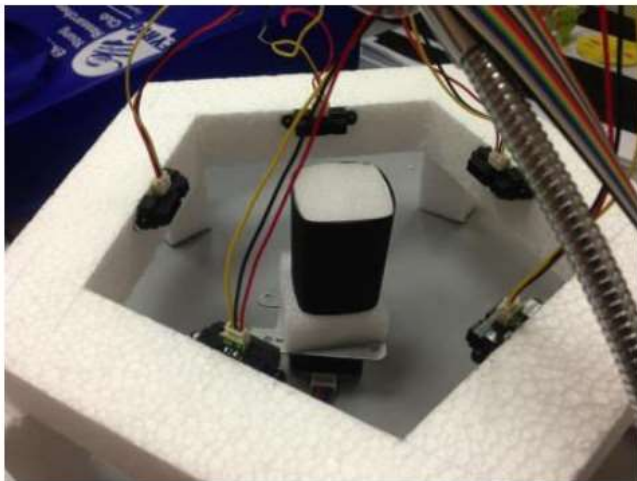


Fig. 1.4 Arrangement of sensor rig with an object located at the centre of the IR

Yogesh Joshi et al. in [5] have proposed a simple encoder decoder based switching circuit to remotely switch OFF/ON an electrical device through a relay. This circuit will build around a 3 pin IR IC receiver TSOP 1738 that can detect 38 KHz burst frequency generated by an encoder based remote. The range of this circuit will be about 10 meters.

Nidhi Verma et al. in [6] have suggested the use of solid state relays for betterment of power system protection. A Relay plays a very important role for power system and is responsible for controlling of any overload voltage or current and to protect devices from these parameters. Due to their advantages solid state relays are used over mechanical relays. Relay functioning will be done with the help of an opto-coupler which is controlled by a microcontroller. Harmonics are reduced by Zero Voltage Switching. This circuit offers minimum delay time for the better protection.

Hamid Farahani et al. in [7] have given the detailed description of different types of relative humidity sensors which are based upon the technologies, specifications, fabrication technologies and sensing materials. It is well known that humidity plays an important role in biology and in automated industrial processes. To get a desired surrounding atmosphere, it is required to monitor, detect and control the ambient humidity for different conditions.

Irfana Kabir Ahmad et al. in [8] have proposed a method to differentiate various recyclable materials like papers and plastics by using capacitance proximity sensors. In their research they have found a new way of using the capacitance proximity sensor which is to identify paper and plastic from the mixed recycling material. The sensor in use can detect the targeted material based on the permittivity of each material. The sensors used in this case are adjusted to the values of plastic and paper.

Ramakrishna G et al. in [9] have proposed an Arduino based safety feature in cars to avoid colliding with a vehicle or any other obstacle in the way. The main objective of this system is to help driver to prevent car collisions due to their careless driving or drowsiness. The proposed system can be connected with the breaking system of the vehicle and thus can be used to reduce the speed of the vehicle. Also the alarm inside the vehicle will go on until the driver is back to his senses

If the driver is still unable to take control of the car within a preset amount of time the car is automatically steered to the one side of the road and halted by this system. Proximity of nearby vehicles, availability of space for taking the vehicle to the road side are taken into account while performing this action.

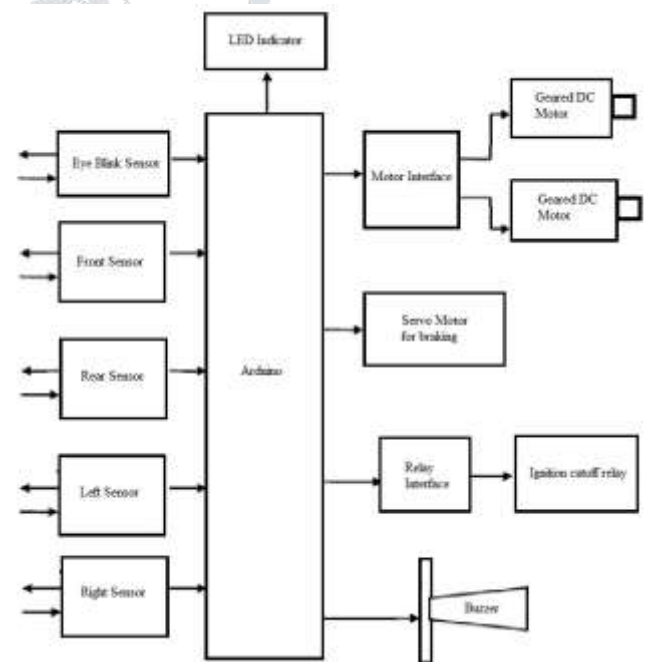


Fig. 1.5 Block diagram

Ahmad Khalid Mostafa in [10] has briefly described an embedded system and how embedded systems benefit people and in what fields. He has stated that every embedded system consists of two parts. The first part is the hardware and the second part is the software. The software part always needs a program that can be used to manipulate the software. Embedded systems are used in variety of applications such as in electronic products, house appliances, medical equipments, automobiles, aerospace and communications.

Danilo Rojas et al. in [11] have proposed an outcome based educational approach for computer engineering students to learn about the embedded systems in embedded system design

laboratory. The new teaching methodology will be based on the modular design and OBE (Outcome Based Education) framework. This methodology presents the opportunity for improvement in the way in which students learn concepts about embedded systems.

II. Conclusion

From the literature review it is followed that (i) Embedded systems play an essential role in the modern life. From small to large scale applications they cover a wide range of engineering applications. (ii) Now a days there is a long list of sensors present in the market that can be used/interfaced with the embedded systems. In the literature review uses of such a few sensors has been mentioned. (iii) With its fast processing and easy interfacing advantages Arduino provides an excellent work platform.

Embedded systems are very multidisciplinary. Mastering them involves learning of several different things like different aspects of programming, algorithms, peripherals, different analog and digital circuits etc. Without proper knowledge of these things and practical knowledge poor skills would be acquired by the students if embedded systems are taught only in theoretical lectures. One of the most important objective of laboratories is to help students in understanding the concept and gaining new knowledge.

So by combining these three points mentioned above, an Arduino based universal kit can be developed to be used in the embedded system laboratory. The aim is to have most of these sensors and components equipped on a very cost effective kit so that it covers a wide range of electronics, communication, electrical and control experiments as generally these laboratories tend to be expensive.

III. References

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