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Competency Demonstration Report

(CDR)

CAREER EPISODE 3

INSERT NAME

3.1: Project Introduction

Name of the Project: Bomb Detection Robotics Using Embedded Controller

Geographical Location   : Kurukshetra, India

Project Duration   : 1st June 2012 to 1st June 2013

Organization   : Kurukshetra University, Haryana, India

Position in the Project   : Team member

CE 3.2 Project Background

CE 3.2.1: Characteristics of the electronics engineering project

The utilization of robotics technology for the purpose of bomb or explosive detection is a novel idea primarily because of the fact that the detection and disposal of the same, when conducted by human resources, increases the risk of loss of life and property by a considerable extent. On the other hand, the utilization of robotic devices not only increases the efficiency of the activity, but also requires less manual operations. Besides this, such systems are also known for their flexibility and dependability. In fact, robots can be utilized to detect the presence of explosive at regions where human experts cannot reach.

It is worth mentioning that in the third phase of my career, I worked as one of the core members of the three-member group working on a project aimed at developing an Embedded Controller based Bomb Detection Robotics system.

CE 3.2.2: Objectives developed for electronics engineering project

The project that undertook was aimed at developing 'robot' that can be controlled though a computing device so as to detect the presence of explosives in the war field, followed by their consecutive disarming. Thus, I determined the objectives of the project work to be the following:

a. To design PC controlled wireless robotic devise capable of detecting the presence of explosives and disarming the same.

b. To implement the PC controlled wireless robotic devise in practice.

c. To put the implemented system into practical use and estimate the efficiency of the same

CE 3.2.3: My area of work

As one of the core members of the project team, I was associated with the task of designing the circuit of the PC controlled wireless robotic devise, along with the practical implementation of the same. I also participated in the process of developing the software modules required for operating the robot in a wireless mode.

Last but not the least, I also developed the project reports and submitted the same to the supervisor and the Head of the department, for facilitating further reviews of the same.

CE 3.2.4: Project Group

The HOD (Head of the Department) of the ECE department of the Kurukshetra University, along with one of the eminent faculty members of the department were in charge of supervising the three-member group that undertook the project. Among the three of us, one member was allocated with the task of leading the others.

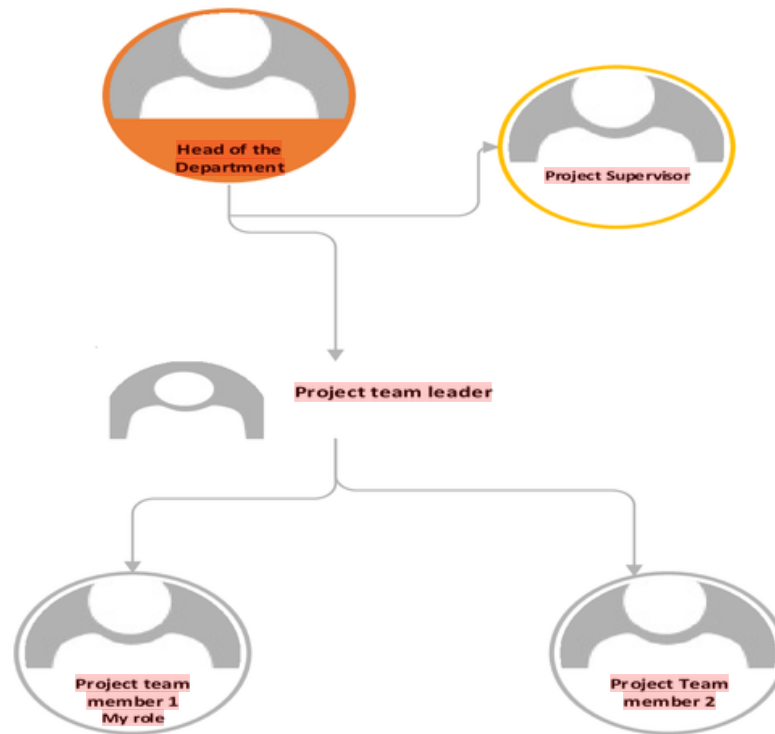The organizational structure of the team has been depicted below:

Figure: Structure of the project group

CE 3.2.5: My responsibilities throughout the project

The first and foremost activity that I was made responsible for included the identification of the electronic components to be utilized in the robotic bomb detection system. In the next phase of the work, I developed the circuit of the system and implemented it practically with the help of the members of my team.

I developed the software code required for operating the robotic device along with deploying the Zigbee interface in between the PIC 16F877A micro controller and the computing device used for controlling the entire bomb detection system.

CE 3.3: Distinctive Activity

CE 3.3.1: Comprehending the Theory of the project

The working model of the Bomb Detection Robotic system developed during the course of this project consists of a handful of electronic and communication modules, namely a PIC 16F877A Micro controller Integrated Circuit, DC motors along with intenerated circuit drivers- 4 in number, power supply components, relay mechanisms and ZigBee modules to be utilized for communicating with the robot wirelessly.

The robotic device has been structured in the following manner: a robotic arm has been placed on a robotic base or vehicle, that has the ability to maneuver over any kind of surface, be it rough or smooth. The vehicle puts into use a set of motors for facilitating its operational activities, whereas a set of caterpillar tracks have been associated with it for ensuring smooth movement over all surfaces.

Among the four DC motors, two are utilized for operating the vehicle, where two others have been utilized for facilitating the operation of the robotic arm fixed on top of it. The robotic arm consists of two jaws, one that operates in the up and down direction, while the other moves in the sideways direction.

The robotic arm has been programmed in such a manner that allows the PC operator to send commands to the same. The metal detector placed on the robotic base is responsible for detecting the presence of explosives that remain hidden in the war field. When one such element is traced, the PC operator remotely determines whether the element is an explosive or not and provides further instructions to the robotic arm for destroying the same.

CE 3.3.2: Engineering Knowledge and Skills applied in the project

In the due course of the project, I have demonstrated my knowledge of electronics and communication engineering by identifying the essential components required for developing the microcontroller based Bomb Detection Robotic system and developing the circuit layout of the same.

I developed the software modules required for supporting the functional operations of the entire system. Besides this, I deployed the ZigBee interfacing between the microcontroller and the manually operated computing device, which controls and monitors the movement of the robotic vehicles and the arm mounted on top of it. I have utilized my skill of numerical calculations and computer programming while performing these activities.

CE 3.3.3: Accomplishment and Task Performed

The team leader associated with this project had given me the responsibility of developing the circuit design of the microcontroller based bomb detection robotic system. With an aim of completing this task, with the help of my teammate I determined the electronic and electrical modules required for developing the system. I also developed the circuit diagram of the entire system: the same has been attached in the section below:
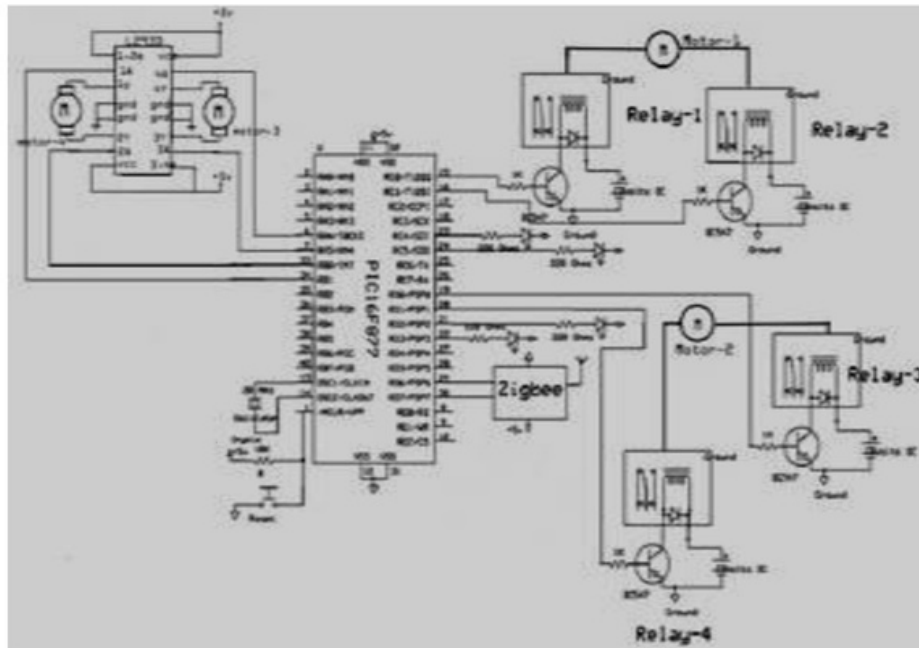
Figure: The circuit diagram of the microcontroller based bomb detection robotic system

After the supervisor approved the circuit diagram, I implemented the same practically on PCB board, and performed the tasks of drilling the board, soldering the components on the PCB, and etching the same.

I also developed the entire robotic setup, consisting of the robotic vehicle and the robotic arm mounted on top of it, along with the implementation of the ZigBee interface between the PC and the microcontroller.
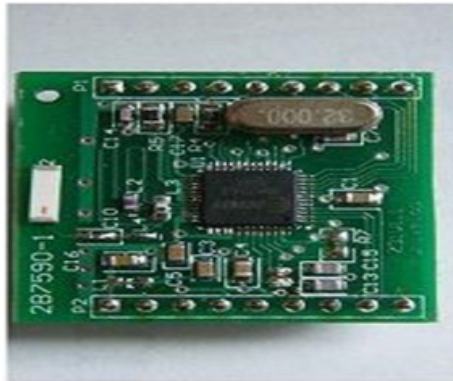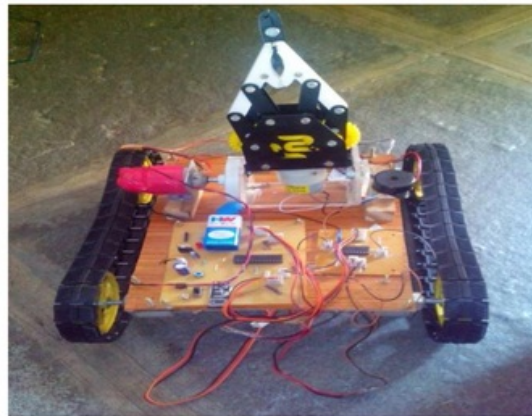
Figure: PCB circuit developed during the project

Figure: Working model of the microcontroller based bomb detection robotic system

as developed during the project

Along with the above-mentioned activities, I documented the findings of the experimental procedures conducted during the project, which turned to be of great help during the documentation phase of the project. I developed the project reports and communicated the same with my supervisors for further review.

CE 3.3.4: Identified Issues and Their Solutions

After mounting the robotic arm on the robotic vehicle, it was found that the wheels attached the base were not capable of supporting the weight of the arm. The smaller wheels were replaced with larger ones, but the vehicle was still found to malfunction while maneuvering over soft surfaces.

I proposed the use of caterpillar tracks instead of the wheels, as the same are widely known for their ability of evenly distributing the load of a vehicle and distributing the same over a large surface area.

CE 3.3.5: Plan for producing creative and innovative work

After the successful completion of each of the sub tasks associated with the project, I reviewed and tested the products several times to ensure that they are fully functional. In fact, it was during the very same process that I observed that the wheels attached to the bas of the robotic vehicle were not operating properly.

I tested the entire PC controlled bomb detection robotic system in an iterative manner, thus identifying the smallest of the flaws that persisted and derived solutions for the same.

CE 3.3.6: Collaborative work

Throughout the entire duration of the project, I have performed all by task kin collaboration with the other members of the team. I have also taken notes of the suggestion made by them, and followed them.

Last, but not the least, I have also discussed the progress of the project with my supervisors in a regular manner, besides preparing the final project reports.

CE 3.4: Project Review

CE 3.4.1: Project Overview

In the final year of my Bachelor's degree in Electronics and Communication, I took part in a project that was aimed at developing a robotic device capable of detecting the presence of bombs and other explosives.

CE 3.4.2: My contribution to work

In this project, I worked on with the task of designing and developing the circuit of the Embedded Controller based Bomb Detection Robotics system, along with the other members of the team. I also participated in the testing and reporting process.

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