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Bomb Diffusing Robotic Arm using Gesture Control

Prof. Anup Kori[1], Ajinkya Dave[2], Mandar Patil[3], Rahul Raut[4], Vaishnavi Save[5]

[1]*Faculty, Department of Electronics & Telecommunication Engineering, Theem college of Engineering, Boisar*

[2]*U.G. Student, Electronics & Telecommunication Engineering, Theem college of Engineering, Boisar*

[3] *U.G. Student, Electronics & Telecommunication Engineering, Theem college of Engineering, Boisar*

[4]*U.G. Student, Electronics & Telecommunication Engineering, Theem college of Engineering, Boisar*

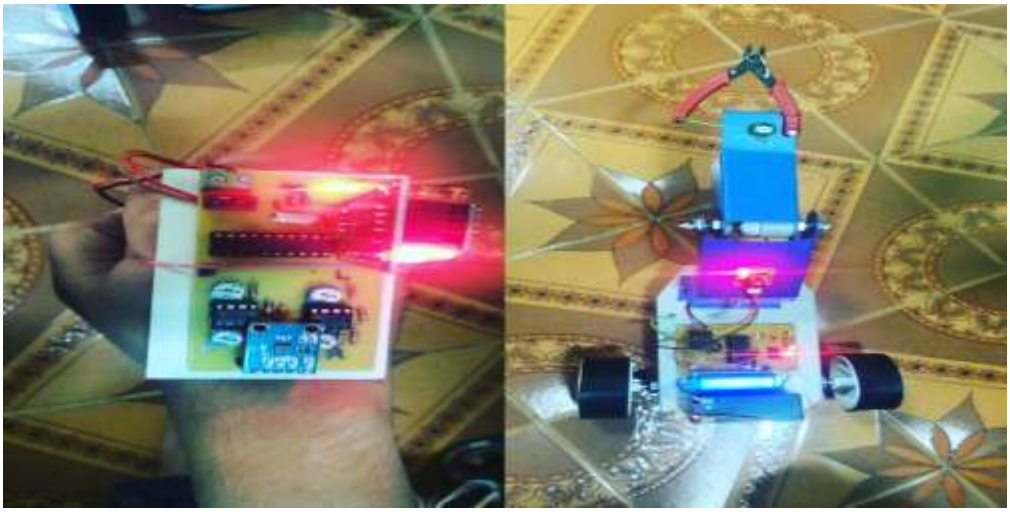
[5]*U.G. Student, Electronics & Telecommunication Engineering, Theem college of Engineering, Boisar*

Abstract *— As we look ahead at various aspects of life we find that most of the work is done by an autonomous device. This makes the work to be done in quite an efficient way, thus by reducing the human efforts. Robotics is such a field that has made a great impact on our day to day life. Robot has found its applications in most of the fields. Such as Automobile, Textile, Product assembling etc .Considering all this abilities of a robot we can make use of them in doing some hazardous jobs. Such as handling poisonous gas/chemicals, Bomb diffusing etc. To do such kind of jobs which has a high amount of risk to human life, Robots can be brought into consideration. With certain specific and precise programming and using proper devices a robot can be made to do work as per the instructions given by the human in real time.*

Keywords-Zig bee, Accelerometer, Micro-controller, User friendly, Remotely Accessible

I. INTRODUCTION

This project deals with the design and implementation of a system that can be brought in to use in our day today life. We have made an attempt to of designing a gesture based bomb diffusing robotic arm. The entire system can be divided into two sections transmitter and receiver respectively. In the transmitter section we are using an accelerometer which is a 3-axis tilt sensor, which provides variable voltage in the output. This output voltage is given to a comparator through a potentiometer network. Depending upon the received variable voltage from the accelerometer the comparator provides an output voltage in terms of various combinations of high or low voltages, which can then be given to the microcontroller as code in terms of 0's and 1's. Depending upon the various values received from the comparator microcontroller performs various coding operations and sent the necessary code via wireless transceiver to the receiver moveable section. At the receiver section depending upon the received code another microcontroller debugs the received code and performs the necessary tasks as per the commands received from the transmitter and drives the motors via the motor driver circuit IC. Depending upon the various received commands various tasks such as FORWARD, BACKWARD, LEFT, RIGHT, ARM UP, ARM DOWN, JAW OPEN, JAW CLOSE can be performed by the moveable platform and robotic arm. The below figure shows the basic prototype:



1.1. Motivation

For motivation let us consider a scenario that came into our mind, consider a target area wherein a bomb has been located. Now when the bomb squad arrives at the target area their main task would be to locate the bomb and try to diffuse it but while diffusing the bomb they are a bit confused between two wires. So in such a case if they cut the wrong wire it may risk their life as well as others too. So considering this scenario into mind we came up with this project.

1.2. Problem definition

While doing survey we found that most of the time a member of the bomb squad has to go personally himself and try to diffuse the bomb and risk his/her life. For many other military applications like to find out bomb/dynamite it becomes difficult for an army official to go their personally and find the bomb/dynamite.

1.3. Objective

The main aim of this project is to avoid risk to human life and successfully disable the bomb causing no risk to human life in an easy way from a far distance sitting a room of appropriate distance from the hazardous area.

1.4. Existing system

The objective of this project is to avoid risk to human life and try to improve the current system of bomb diffusing in which an individual has to go personally and detect the bomb and then try to diffuse it thus, by risking his and others life too.

II. RELATED WORK

As we look around today there has been a lot of research in progress in the field of robotics especially in development of Robotic arm. In this part we have described some of the Robotic arm which are in use.

Few systems are:

2.1. Vision-based Gesture Recognition [1]

This Recognition system basically worked in the field of Service Robotics and the researchers finally designed a Robot performing the cleaning task. They designed a gesture-based interface to control a mobile robot equipped with a manipulator. The interface uses a camera to track a person and recognize gestures involving arm motion. A fast, adaptive tracking algorithm enables the robot to track and follow a person reliably through office environments with changing lighting conditions. Two gesture recognition methods i.e. a template based approach and a neural based approach were compared and combined with the Viterbi algorithm for the recognition of gestures defined through arm motion. It results in an interactive clean-up task, where the user guides the robot to go to the specific locations that need to be cleaned and also instructs the robot to pick up trash.

2.2. Motion Capture Sensor Recognition [2]

This recognition technique made it possible to implement an accelerometer based system to communicate with an industrial robotic arm wirelessly. In this particular project the robotic arm is powered with ARM7 based LPC1768 core. MEMS is a three dimensional accelerometer sensor which captures gestures of human-arm and produces three different analog output voltages in three dimensional axes. And two flex sensors are used to control the gripper movement.

2.3. Finger Gesture Recognition System based on Active Tracking Mechanisms [3]

The prime aim of the system (based on the above mentioned recognition methodology) proposed by the author is to make it feasible to interact with a portable device or a computer through the recognition of finger gestures. Apart from the gestures, speech can also be other mode of interaction because of which this system can form part of a so-called Perceptual User Interface (PUI). The system could be used for Virtual Reality or Augmented Reality systems.

2.4. Accelerometer-based Gesture Recognition [4]

This Gesture Recognition methodology has become increasingly popular in a very short span of time. The low-moderate cost and relative small size of the accelerometers are the two factors that make it an effective tool to detect and recognize human body gestures. Several studies have been conducted on the recognition of gestures from acceleration data using Artificial Neural Networks.

III. Literature Survey

We researched a lot on the design and implementation of the hand gesture recognition method for diffusing a bomb and we came up with a mechanism of using a potentiometer along with comparator to be fitted on the glove. We came up with the circuit diagram and implementation methodology from various websites on internet. As we looked out at the instrument used for diffusing the bomb we came up with implementing a wire stripper on the arm for bomb diffusing.

IV. Components

4.1. Accelerometer Sensor:

ADXL335 is a small, thin, low-power tilt sensor which can detect the tilt in 3-axis. It is a 5 pin sensor which has VDD, GND, and three output pins for X, Y and Z axis respectively. It can provide an output voltage ranging from 1.3v to 1.9v depending upon the type of accelerometer and also for the purpose which it is needed. For our project we are using only two axis X & Y to control the robot. To convey the output received from the sensor to micro controller we are using a set of comparators.

4.2. Microcontroller (AT89s2051):

Atmel 89c2051 microcontroller is 20 pin low power, providing high performance 8-Bit microcontroller it is basically the most important part of the transmitter section. It has 128 Byte of internal RAM, 15 Bi-directional programmable I/O lines and two 16-Bit internal timer/counter. AT89c2051 receives the data from comparators and transmits it through the zigbee module.

4.3. Microcontroller (AT89c52):

AT89s52 is a 40 pin low voltage, high performance on board programmable 8-bit microcontroller it performs all the tasks at the receiver side. It has 128 Byte of internal RAM, 32 Bi-directional programmable I/O lines and two 16-Bit internal timer/counter. AT89s52 is the heart of receiver section all the data received from the zigbee is processed and depending upon the received data motor is driven.

4.4. ZIGBEE TRANSCIEVER (nRF24L01):

nRF24L01 is a low cost, more secure, reliable, low power consumption device. It works on a 2.4GHz ISM band which is applicable worldwide providing a data rate up to 2Mbps. It is a 4-pin device TX, RX, VDD & GND. It can operate within a range of maximum 100meters.

4.5. DC Motor Driver IC (L293D):

It's a four channel motor Driver IC having up to 600mA output current capability per channel with channel enables facility. The output code received from the microcontroller is used by the driver circuit to drive the DC motors of the moveable platform and robotic arm.

V. Conclusion

After undergoing various designs and trying different implementations for robotic arm we came up with this prototype. As our prime objective was to design a system which could be brought under use for military application. We have made an attempt on developing a simple algorithm which can be used for gesture recognition. Currently we were able to recognize eight gestures of human hands with certain advancements a more set of gestures can be recognized. This gesture recognition algorithm is quite simple but will be needed to improved for on field application of Bomb Diffusing

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