Intelligent Prosthetic Hand Using Hybrid Actuation

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Abstract- *Now-a-days, people face several human disasters such as bomb blast, gunshot and many more terrorist activities. Especially Bomb Blasting causes severe destructions compare to other harms. Bomb detection is the major threat for people and refusing the placed bomb is a difficult and most threatening job. The most important motto of this work is to identify the location of the bomb and alerting the person regarding the bomb position. As well as the system provides simple ways to refuse the bomb in intelligent manner. It is known that the population is increasing at very peak ranges all over the world. But also the deaths are exponentially increasing. Among them most of the deaths occurs due to accidents and diseases. Since we are on the era of advanced technology, we can utilize these technological growths to enhance the safety and security towards death causing crisis like accidents and spreading of disease. These technologies also provide some aids to prevent us from experiencing major problems caused by accidents and diseases. So here we utilize the technological advancement to enable the immune system for us to survive any such scenarios. We propose a system which detects and diffuses bomb in an area. For all the proposed approach guarantees the bomb avoidance scenario and provides complete safety measure to the people.*

Keywords- Bomb Identification and Refusing, EMG, MEMS, Bomb Detector, EMP Device.

I. INTRODUCTION

The main idea of the system is derived with powerful sensors and which are used to identify the bomb and help to refuse it. The major application modules are summarized below:

A. EMG Sensor

Electromyography (EMG) enables the translation of this surface into electrical signals, enabling them to be used in a wide array of applications. Our sensor is especially designed for surface EMG, and works both with pre-gelled and most types of dry electrodes. The bipolar configuration is ideal for low-noise data acquisition, and the raw data output enables it to be used for human-computer interaction and biomedical. Electromyography (EMG) is an electro diagnostic medicine technique for evaluating and recording the electrical activity produced by skeletal muscles. To conduct EMGs, the red and green leads need to be placed on electrodes that are attached to the muscle of interest.

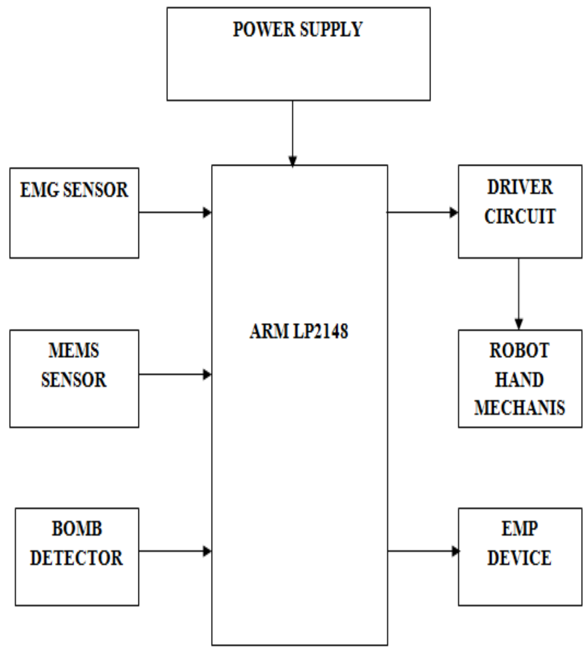

Fig.1 Proposed Block Diagram

The two leads are interchangeable for EMGs. Place these leads along the length of the muscle. The black lead serves as a ground. It should not be placed on the muscle of interest. For example, to record from the muscles of the ventral forearm, attach three electrode tabs to the subject as shown in Figure 2. Two electrode tabs should be placed on the ventral forearm, 5 and 10 cm from the medial epicondyle with the ground electrode on the upper arm. Alternatively, the ground electrode can be placed on the wrist of the adjacent arm to minimize movement artifacts. The major applications of EMG Sensor are: Human-Computer Interaction, Robotics and Cybernetics, Physiology studies, Psychophysiology Biomechanics, Biofeedback, Muscle reflex studies and Nerve conduction measurement.

Fig.2 EMG Sensor

B. MEMS Sensor

Micro-electro-mechanical Systems (MEMS) Technology is one of the most advanced technologies that have been applied in the making of most of the modern devices like video projectors, bi-analysis chips and also car crash airbag sensors. This concept was first explained by Professor R. Howe in the year 1989. Since then many prototypes have been released and revised and has thus become an integral part of the latest mechanical products available in the market today. During its early stage, the MEMS chip had two parts. One part included the main structure of the chip and the other part included everything needed for signal conditioning. This method was not successful as the total space taken by the device was larger, and thus the different parts of a single chip needed multi-assembling procedures. The output obtained from such a device had less accuracy and the mounting of such a device was difficult. As the technology became more advanced the idea of integrating multi-chips was applied on to produce a single chip MEMS with high performance and accuracy.

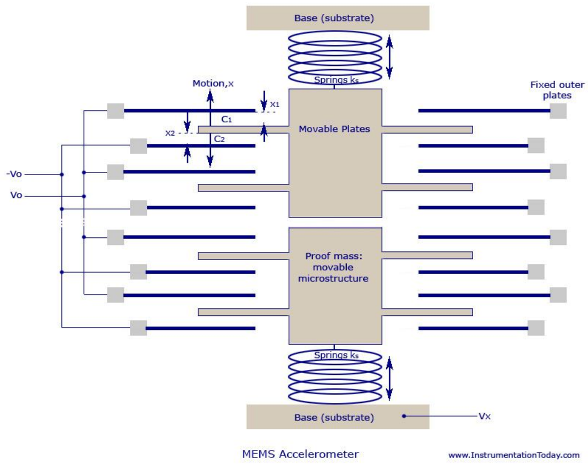

Fig.3 MEMS Accelerometer

The main idea behind this technology is to use some of the basic mechanical devices like cantilevers and membranes to have the same qualities of electronic circuits. To obtain such a concept, micro-fabrication process must be carried out. Though an electronic process is carried out, an MEMS device cannot be called as an electronic circuit. MEMS duplicate a mechanical part and have holes, cantilevers, membranes, channels, and so on. But an electronic circuit has a firm and compact structure. To make MEMS from silicon process, the manufacturer must have a deep knowledge in electronics, mechanical and also about the materials used for the process. The major advantages of MEMS Sensor are: (a) MEMS device are very small and can be applicable for many mechanical purposes where large measurements are needed, (b) The small size of the device has also helped in reducing its cost and (c) If two or three different devices are needed to deploy a particular process, all of them can be easily integrated in an MEMS chip with the help of microelectronics. Thus, data reception, filtering, storing, transfer, interfacing, and all other processes can be carried out with a single chip.

The major applications of MEMS Sensor are: (a) The device is highly applicable as an accelerometer, and thus can be deployed as airbag sensors or in digital cameras in order to stabilize the image, (b) Can be used as a pressure sensor so as to calculate the pressure difference in blood, manifold pressure (MAP), and also tire pressure, (c) It is commonly used in a gyroscope, DNA chips and also inkjet printer nozzle, (d) Optical MEMS is used for making projectors, optical fiber switch and so on and (e) RFMEMS is used for making antennas, filters, switches, relays, RAM’s microphones, microphones, and so on.

II. PAST SYSTEM – A SUMMARY

The system fails to diffuse the bomb in an area. The system is just used to detect the bomb in an area. This does not provide a system to save lives. The existing approaches has several disadvantages, some of them are listed below: (a) Explosives sniffer dogs do not and cannot operate by themselves. They always function in tandem with their handler, (b) Humans are need to carry the bomb detection gadgets and (c) there is no automatic diffusion process.

III. PROPOSED SYSTEM

We propose a system which consists of an EMG sensor. The EMG sensor is used to open and close the Hand model. The hand model is used to pick the bomb in the detected zone. The MEMS sensor is used to detect whether the hand section in the system is working or not. Based on that we can detect whether the system hand model is working or not. The Bomb detector is used to detect whether the bomb is present in a place or not. If the bomb is detected, then the EMP used in the circuit destroys the electronic bomb by passing electromagnetic waves. The proposed system has several advantages, some of them are listed below: (a) This system is the easiest way to track bomb location (b) And automatic bomb diffusion process and (c) It saves the human life's.

Transformer Unit

The potential transformer will step down the power supply voltage (0-230V) to (0-6V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op–amp. The advantages of using precision rectifier are it will give peak voltage output as DC; rest of the circuits will give only RMS output.

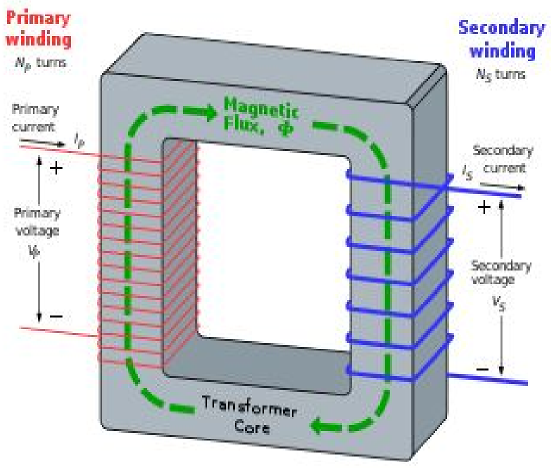

Fig.4 Transformer

Driver Circuit

The ULN2003 is a monolithic high voltage and high current Darlington transistor arrays. It consists of seven NPN Darlington pairs that feature high-voltage outputs with common-cathode clamp diode for switching inductive loads. The collector-current rating of a single Darlington pair is 500mA. The Darlington pairs may be paralleled for higher current capability. Applications include relay drivers, hammer drivers, lamp drivers, display drivers (LED gas discharge), line drivers, and logic buffers. The ULN2003 has a 2.7kW series base resistor for each Darlington pair for operation directly with TTL or 5V CMOS devices.

The driver circuit contains several unique features, some of them are listed below: (a) 500mA rated collector current (Single output), (b) High-voltage outputs: 50V, (c) Inputs compatible with various types of logic and (d) Relay driver application.

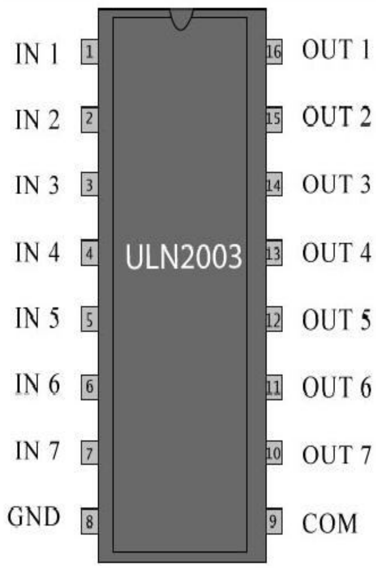

Fig.5 Driver Circuit

IV. LITERATURE SURVEY

In the year of 2017, the authors "Uriel Martinez-Hernandez, Luke W. Boorman, Tony J. Prescott" proposed a paper titled "Multisensory wearable interface for immersion and telepresence in Robotics", in that they described such as: the idea of being present in a remote location has inspired researchers to develop robotic devices, that make humans to experience the feeling of telepresence. These devices need of multiple sensory feedback to provide a more realistic telepresence experience. In this paper, we develop a wearable interface for immersion and telepresence that provides to human with the capability of both to receive multisensory feedback from vision, touch, and audio, and to remotely control a robot platform. Multimodal feedback from a remote environment is based on the integration of sensor technologies coupled to the sensory system of the robot platform. Remote control of the robot is achieved by a modularized architecture, which allows to visually exploring the remote environment.
We validated our paper with multiple experiments where participants, located at different venues, were able to successfully control the robot platform while visually exploring, touching, and listening a remote environment. In our experiments, we used two different robotic platforms: 1) the iCub humanoid robot and 2) the Pioneer LX mobile robot. These experiments show that our wearable interface is comfortable, easy to use, and adaptable to different robotic platforms. Furthermore, we observed that our approach allows humans to experience a vivid feeling of being present in a remote environment.

In the year of 2016, the authors "Marco Janko, Richard Primerano, Yon Visell" proposed a paper titled "On Frictional Forces between the Finger and a Textured Surface during Active Touch", in that they described such as: We investigated forces felt by a bare finger in sliding contact with a textured surface, and how they depend on properties of the surface and contact interaction. Nevertheless, how texture-produced forces depend on the properties of a touched object or the way that it is touched is less clear.

To address this, we designed an apparatus to accurately measure contact forces between a sliding finger and a textured surface. We fabricated textured surfaces, and measured spatial variations in forces produced as subjects explored the surfaces with a bare finger. We analyzed variations in these force signals, and their dependence on object geometry and contact parameters. We observed a number of phenomena, including transient stick-slip behavior, nonlinearities, phase variations, and large force fluctuations, in the form of aperiodic signal components that proved difficult to model for fine surfaces. Moreover, metrics such as total harmonic distortion and normalized variance decreased as the spatial scale of the stimuli increased. The results of this study suggest that surface geometry and contact parameters are insufficient to account for force production during such interactions. Moreover, the results shed light on perceptual challenges solved by the haptic system during active touch sensing of surface texture.

In the year of 2016, the authors "Uriel Martinez-Hernandez, Adrian Rubio-Solis, Tony J. Prescott" proposed a paper titled "Bayesian perception of touch for control of robot emotion", in that they described such as: in this system, we present a Bayesian approach for perception of touch and control of robot emotion. Touch is an important sensing modality for the development of social robots, and it is used in this work as stimulus through a human-robot interaction.

A Bayesian framework is proposed for perception of various types of touch. This method together with a sequential analysis approach allows the robot to accumulate evidence from the interaction with humans to achieve accurate touch perception for adaptable control of robot emotions. Facial expressions are used to represent the emotions of the iCub humanoid. Emotions in the robotic platform, based on facial expressions, are handled by a control architecture that works with the output from the touch perception process. We validate the accuracy of our system with simulated and real robot touch experiments. Results from this work show that our method is suitable and accurate for perception of touch to control robot emotions, which is essential for the development of sociable robots.

V. EXPERIMENTAL RESULTS

The following figure illustrates the proposed system implementation.

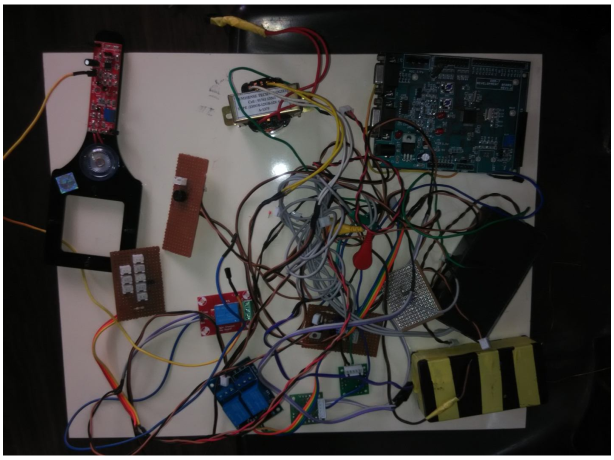

Fig.6 Experimental Setup of the Proposed System

Conclusion

Overall, an autonomous robot with a wire cutter that perform diffusion operation has been successfully built. The robot has been able to detect and diffuse bombs effectively. The robot been made is a working prototype of the bomb detection and diffusion robot vehicle. By using an effective microcontroller, the robot have performed it task perfectly according to the program that being made. Further, developments like, introducing usage of other connections like IOT will be advantageous in the respect of range.

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