MEMS Based Gesture Controlled Robot Using Wireless Communication

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Abstract: The paper describes a robustness of MEMS based Gesture Controlled Robot is a kind of robot that can be by our hand gestures rather than an ordinary old switches or keypad. In Future there is a chance of making robots that can interact with humans in an natural manner. Hence our target interest is with hand motion based gesture interfaces. An innovative Formula for gesture recognition is developed for identifying the distinct action signs made through hand movement. A MEMS Sensor was used to carry out this and also an Ultrasonic sensor for convinced operation. In order to full-fill our requirement a program has been written and executed using a microcontroller system. Upon noticing the results of experimentation proves that our gesture formula is very competent and it's also enhance the natural way of intelligence and also assembled in a simple hardware circuit.

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I. INTRODUCTION

Technology is the word coined for the practical application of scientific knowledge in the industry. The advancement in technology cannot be justified unless it is used for leveraging the user's purpose. Technology, is today, imbibed for accomplishment of several tasks of varied complexity, in almost all walks of life. The society as a whole is exquisitely dependent on science and technology. Technology has played a very significant role in improving the quality of life. One way through which this is done is by automating several tasks using complex logic to simplify the work.Gesture recognition has been a research area which received much attention from many research communities such as human computer interaction and image processing. The increase in human-machine interactions in our daily lives has made user interface technology progressively more important. Physical gestures as intuitive expressions will greatly ease the interaction process and enable humans to more naturally command computers or machines. Now a day's robots are controlled by remote or cell phone or by direct wired connection. If we thinking about cost and required hardware's all this things increases the complexity, especially for low level application. For example, in tele-robotics, slave robots have been demonstrated to follow the master's hand motions remotely [1].

Gestures control robots are extensively employed in human non-verbal communication. They allow to express orders (e.g. "stop"), mood state (e.g. "victory" gesture), or to transmit some basic cardinal information (e.g. "two"). In addition, in some special situations they can be the only way of communicating, as in the cases of deaf people (sign language) and police's traffic coordination in the absence of traffic lights, a real-time continuous gesture recognition system for sign language Face and Gesture recognition.

Robots are becoming increasingly useful on the battlefield because they can be armed and sent into dangerous areas to perform critical missions. Controlling robots using traditional methods may not be possible during covert or hazardous missions. A wireless data glove was developed for communications in these extreme environments where typing on a keyboard is either impractical or impossible. This paper reports an adaptation of this communications glove for transmitting gestures to a military robot to control its functions. Novel remote control of robots has been an active area of research and technology, especially over the past decade. For example, a wearable, wireless tele-operation system was developed for controlling robot with a multi-modal display. Remotely controlled robots have been used in environments where conditions are hazardous to humans.

Gestures were used to control a flying manta-ray model. A glove apparatus was used to control a wheelchair using robotic technology. Other proposed applications of recognizing hand gestures include character-recognition in 3-D space using inertial sensors [2], [3], gesture recognition to control a television set remotely [4], enabling a hand as a 3-D mouse [5], and using hand gestures as a control mechanism in virtual reality [6]. It can also be used for the improvement of interaction between two humans. In our work, a miniature MEMS accelerometer based recognition system which can recognize eight hand gestures in 3-D space is built. The system has potential uses such it act as a vocal tract for speech impaired people. To overcome the limitations such as unexpected ambient optical noise, slower dynamic

response, and relatively large data collections/processing of vision-based method [9], and to strike a balance between accuracy of collected data and cost of devices, a Micro Inertial Measurement Unit is utilized in this project to detect the accelerations of hand motions in three dimensions. The proposed recognition system is implemented based on MEMS acceleration sensors. Since heavy computation burden will be brought if gyroscopes are used for inertial measurement [10], our current system is based on MEMS accelerometers only and gyroscopes are not implemented for motion sensing. Fig.1 shows the system architecture of the proposed gesture recognition system based on MEMS accelerometer. The details of the individual steps are described below.

II. SYSTEM DESIGN MODEL

A. Software design module

For the operation purpose, the user application instructions are written programming code by using **embedded c**. The application program is compiled by using **KEIL-C** compiler and converts the source file into **.hex file**. For the dumping purpose, we use micro flash programmer. Here the program is dumped in the microcontroller **ROM memory** location. The µVision3 screen provides us with a menu bar for command entry, a tool bar where we can rapidly select command buttons, and windows for source files, dialog boxes, and information displays. µVision3 lets us simultaneously open and view multiple source files.

A project contains enough information to take a set of source files and generate exactly the binary code required for the application. Because of the high degree of flexibility required from the tools, there are many options that can be set to configure the tools to operate in a specific manner. It would be tedious to have to set these options up every time the application is being built; therefore they are stored in a project file. Loading the project file into KEIL informs KEIL which source files are required, where they are, and how to configure the tools in the correct way. The user of KEIL centers on "projects". A project is a list of all the source files required to build a single application, all the tool options which specify exactly how to build the application, and – if required – how the application should be simulated. The project can then be saved to preserve the settings. The project is reloaded and the simulator or debugger started, all the desired windows are opened. KEIL project files have the extension.

B. Hardware design module

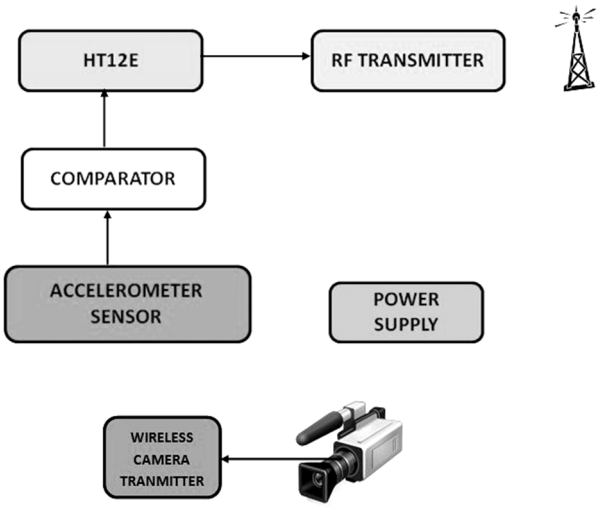
In cases there is a requirement of a mechanism where in the chair should be controlled without any physical contact. Therefore gesture is our choice in order to achieve this primary goal. Gesture is a nonverbal and easier physical action. A sensor that takes gesture as its input can do this job. The Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others. The MMA7361L is a low power, low profile capacitive micro machined accelerometer featuring signal conditioning, a 1-pole low pass filter, temperature compensation, self test, 0g-Detect which detects linear freefall, and g-Select which allows for the selection between 2 sensitivities. Zero-g offset and sensitivity are factory set and require no external devices. The MMA7361L includes a Sleep Mode that makes it ideal for handheld battery powered electronics.

The RF module, as the name suggests, operates at Radio Frequency. The corresponding frequency range varies between 30 kHz & 300 GHz. In this RF system, the digital data is represented as variations in the amplitude of carrier wave. This kind of modulation is known as Amplitude Shift Keying (ASK).Transmission through RF is better than IR (infrared) because of many reasons. Firstly, signals through RF can travel through larger distances making it suitable for long range applications. Also, while IR mostly operates in line-of-sight mode, RF signals can travel even when there is an obstruction between transmitter & receiver. Next, RF transmission is more strong and reliable than IR transmission. RF communication uses a specific frequency unlike IR signals which are affected by other IR emitting sources. The HT 12E Encoder ICs are series of CMOS LSIs for Remote Control system applications. They are capable of Encoding 12 bit of information which consists of N address bits and 12-N data bits. Each address/data input is externally programmable if bonded out. The HT 12D ICs are series of CMOS LSIs for remote control system applications. These ICs are paired with each other. For proper operation a pair of encoder/decoder with the same number of address and data format should be selected. The Decoder receive the serial address and data from its corresponding decoder, transmitted by a carrier using an RF transmission medium and gives output to the output pins after processing the data. The L293 and L293D are quadruple high-current half-H drivers. The L293 is designed to provide bidirectional drive currents of up to 1 A at voltages from 4.5 V to 36 V. The L293D is designed to provide bidirectional drive currents of up to 600-mA at voltages from 4.5 V to 36 V. Both devices are designed to drive inductive loads such as relays, solenoids, dc and bipolar stepping motors, as well as other high-current/high-voltage loads in positive-supply applications.

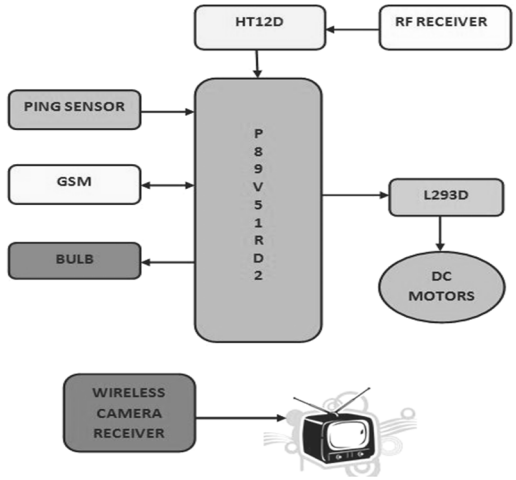
A GSM modem is a wireless modem that works with a GSM wireless network. A wireless modem behaves like a dial-up modem. The main difference between them is that a dial-up modem sends and receives

data through a fixed telephone line while a wireless modem sends and receives data through radio waves.

Transmitting section: The above transmitting diagram indicates the transmitting section which includes an accelerometer whose output is in continuous form as the encoder can only understands the digital data we are using the comparator for converting the analogy data to digital data and this data is to be transmitted so we are using radio transmitter which transmits the serial data converted by the encoder from parallel data.

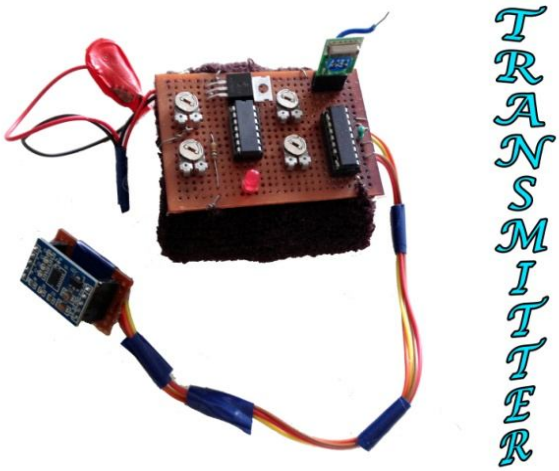


Receiving Section: The above receiving block diagram indicates the receiver section the transmitted data by the transmitter is received by the RF receiver and the serial data is given as input to the decoder which converts the serial data to parallel data and is given as input to the microcontroller which consists of a predefined program to fulfil our task, depending upon the data received the controller generates some signals to the motor driver LED's buzzer's etc., here the purpose of the motor driver is to drive the motors and here LED's and buzzer are used for some specific indications Various types of modules like ping module, GSM module are used.The ultrasonic sensor output signal is fed to the microcontroller in which a suitable embedded 'c' program is written the algorithm here,to indicate the presence of an obstacle. Here the GSM module includes a SIM used for Tran's receiver for the controller to do a task which includes a glowing of bulb that represents a bomb.

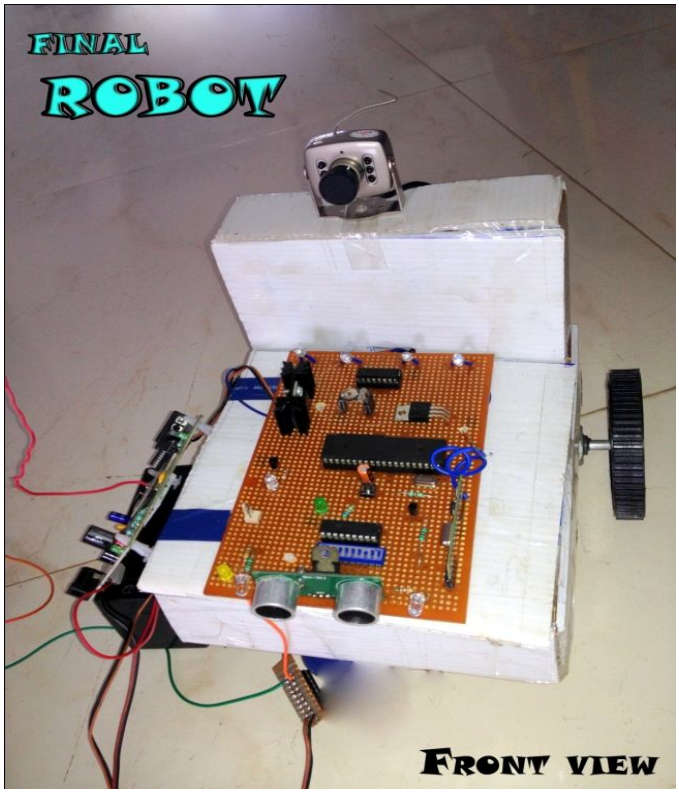


III. EXPERIMENTAL RESULTS

In the area of safety, for example, many machines require operators to place each hand on a control switch before the controller starts any action. Instead of having operators move their hands to special switches, why not simply let them hold up their hands with a gesture sensor? This type of control could improve productivity, reduce the effects of repetitive motions, and improve safety. Advanced robotic arms that are designed like the human hand itself can easily controlled using hand gestures only. The arm controller wears the sensor gloves and the robotic arm will mimic the movement of the controller. Advanced robotic arms like these can perform complex and hazardous tasks with ease. Proposed utility in fields of construction, hazardous waste disposal, medical sciences.



Robot Section:



IV. CONCLUSION

We proposed a fast and simple algorithm for hand gesture recognition for controlling robot. We have demonstrated the effectiveness of this computationally efficient algorithm on real images we have acquired. In our system of gesture controlled robots, we have only considered a limited number of gestures. Our algorithm can be extended in a number of ways to recognize a broader set of gestures. The gesture recognition portion of our algorithm is too simple, and would need to be improved if this technique would need to be used in challenging operating conditions. Reliable performance of hand gesture recognition techniques in a general setting require dealing with occlusions, temporal tracking for recognizing dynamic gestures, as well as 3D modelling of the hand, which are still mostly beyond the current state of the art.

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