Dual Sensor Based Gesture Robot Control Using Minimal Hardware System

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***Abstract*--** This paper presents a Gesture Controlled robot which can be controlled by your hand gestures not by the usual method of keypad. Robots of the future should communicate with humans in a natural way. Hence we are especially interested in hand motion based gesture interfaces A novel algorithm for gesture identification is developed for identifying the various gesture signs made through hand movement.. This is implemented using mems sensor as well as using ultrasonic sensor for certain application. A program has been written and executed for the same purpose using microcontroller system. The observed experimentation proves that our gesture algorithm is more effective and its also improves the natural way of communication and built in a simple hardware circuit.

***Index Terms*-** MEMS sensor, hand gesture recognition communication, microcontroller.

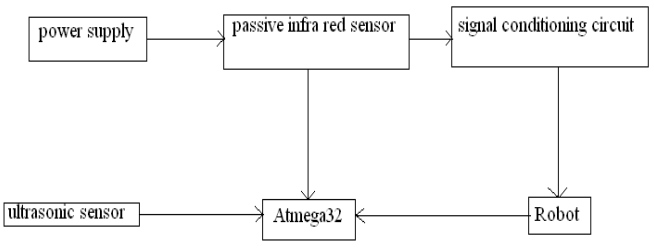
I. INTRODUCTION

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[1] R.H. Liang, M. Ouhyoung, a real-time continuous gesture recognition system for sign language Face and Gesture Recognition, 1998, pp.558–565.. Thus, it seems convenient that human-robot interfaces incorporate hand gesture recognition capabilities. For instance, we would like to have the possibility of transmitting simple orders to personal robots using hand gestures. The recognition of hand gestures requires both hand's detection and gesture's recognition. Both tasks are very challenging, mainly due to the variability of the possible hand gestures (signs), and because hands are complex, deformable objects (a hand has more than 25 degrees of freedom, considering fingers, wrist and elbow joints) that are very difficult to detect in dynamic environments with cluttered backgrounds and variable illumination. Several hand detection and hand gesture recognition systems have been proposed. Early systems usually require markers or colored gloves to make the recognition easier.

Human-robot symbiotic systems have been studied extensively in recent years, considering that robots will play an important role in the future]. The use of intelligent robots encourages the view of the machine as a partner in communication rather than as a tool. In the near future, robots will interact closely with a group of humans in their everyday environment in the field of entertainment, recreation, health-care, nursing, etc.

In human-human interaction, multiple communication modals such as speech, gestures and body movements are frequently used. The standard input methods, such as text input via the keyboard and pointer/location information from a mouse, do not provide a natural, intuitive interaction between humans and robots. Therefore, it is essential to create models for natural and intuitive communication between humans and robots. Furthermore, for intuitive gesture-based interaction between human and robot, the robot should understand the meaning of gesture with respect to society and culture. The ability to understand hand gestures will improve the naturalness and efficiency of human interaction with robot, and allow the user to communicate in complex tasks without using tedious sets of detailed instructions.

II. BLOCK DIAGRAM



III. WORKING PRINCIPLE

The PIR sensor is normally used for motion detection, in our circuit the sensor is connected in the port D and the status of the pin is read, suppose the output of the sensor goes high then at once any motion in the form of gesture being detected is used to control an Electrical appliance for example in our case we have to chosen to switch of an servo motor. The ultrasonic sensor output signal is fed to the microcontroller ATMEGA32 via the serial interface. A suitable embedded 'c' program is written the algorithm here, read the different hand gesture sign senses by the ultrasonic sensor and becomes different control operation. The PIR sensor as interface through port D of the atmega32 and the high signal output is sensed and used for control application of motor when ever distance is detected the sensor act as substitute for image sensor and hand control ON/OFF operation of motor.

III A. PIR SENSOR

The PIR (Passive Infra-Red) Sensor is a piezoelectric device that detects motion by measuring changes in the infrared (heat) levels emitted by surrounding objects. When motion is detected the PIR Sensor outputs a high signal on its output pin. This logic signal can be read by a microcontroller or used to drive an external load. The PIR sensor as interface through port D of the ATMEGA32 and the high signal output is sensed and used for control application of motor when ever distance is detected the sensor act as substitute for image sensor and hand control ON/OFF operation of motor.

III B. FEATURES

- Detecting range : 360 degrees cone angle, 15-20 feet
- Single bit output
- Jumper selects single or continuous trigger output mode
- 3-pin SIP header
  Small size makes it easy to conceal
- Compatible with any microcontroller like Basic Stamp, Adriano, At mega, PIC, 8051, propeller.

III C. ULTRASONIC SENSOR

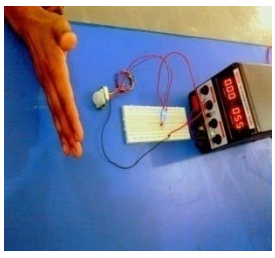
The ultrasonic sensor is utilized as substitute and the gesture is recognized in terms of different distances and the hand movements for various distance acts as gesture sign for control applications. The ultrasonic sensor output signal is fed to the microcontroller ATMEGA32 via the serial interface. A suitable embedded 'c' program is written the algorithm here, read the different hand gesture sign senses by the ultrasonic sensor and becomes different control operation.

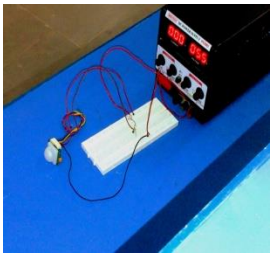
III D. PICTURE OF ROBOT

III E. HAND CONTROL USING HAND GESTURE

Technique to acquire hand gestures and to control robotic system using hand gestures is:

- PIR sensor acquisition to get hand gestures.
- Extracting hand gesture area from captured frame.
- Generation of instructions corresponding to matched gesture, for specified robotic action.





IV. APPLICATIONS

1. In aero space for detection of obstacle during takeoff and landing upon air wings.

2. This eliminates the use of camera sensor and provides the low cost hardware.

V. CONCLUSION

The control algorithm developed is based on the larger distance measured by the ultrasonic sensor, the work can be further extended for small distance measurement and controlling applications which would eliminate the use of kinect sensor which are very costlier and this dual sensor system setup is very economical for small scale applications.

Mechatronics engineers already have programming languages such as ROBOTC (based on C) and RAIL (based on Pascal) that control robot actions and sensors. But these languages use the same fundamental line-by-line code I learned in the mid-1960s! The mechatronics capabilities of equipment and robots have expanded, but programmers still control them with old-fashioned languages. National Instruments' LabVIEW software provides a higher-level graphical programming approach that better abstracts engineers from languages. So we have taken a step in the right direction.

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 or fingers in front of a gesture sensor? This type of control could improve productivity, reduce the effects of repetitive motions, and improve safety.

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