

SPY ROBOT CONTROLLING THROUGH ZIGBEE USING MATLAB

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ABSTRACT

In today's world, in almost all sectors, most of the work is done by robots. In this paper, a spy robot can be developed by using natural gestures of the humans. The software part of the system uses gesture based image processing technique. This system uses a camera to capture the image of hand gesture. The captured image of the hand is processed to understand the gesture commands. Human machine interaction can be developed by converting the gesture commands into a signal. The hardware part is developed based on Arduino microcontroller. The Spybot is programmed to understand the gesture command signal and navigate according to hand gestures. In this way the user can control the robot by simple hand gestures. The camera placed on the robot capture the images of its surrounding, wherever it travels and send it back to the PC for monitoring. The gesture commands can be used for controlling the Spybot functions such as movement of the robot, or other operations of the robot silently. The system can be directly applied to defence grounds for detection of enemy, for spying purpose where the human reach is avoided or not recommended.

Key words: Gesture controlled robot, gesture signal processing, spybot, Zigbee module, Arduino Uno microcontroller board.

I. INTRODUCTION

Now a days, humans are working on developing the new techniques of interacting with the robot. The gesture is one of these techniques which is more flexible than other. Gestures used for communicating between humans and machines as well as between people using sign language. Gesture can be static which requires less computational complexity (or) dynamic which are more complex but suitable for real time environments. Different methods have been proposed for acquiring information necessary for gesture recognition system. Some methods used additional hardware devices such as data glove devices and color markers to easily extract comprehensive description of gesture features other methods based on the appearance of the hand using the skin color to segment the hand and extract necessary features, these methods considered easy, natural and less cost comparing with other methods.

Some recent reviews explained gesture recognition system applications and its growing importance in our life especially for human computer interaction(HCI).The proposed work does not require any special equipment like glove or other devices to be attached to the body to sense

the movements. It is totally based on the image processing technique. Thus, gesture signal processing module extracts information from the gesture input given by the user.

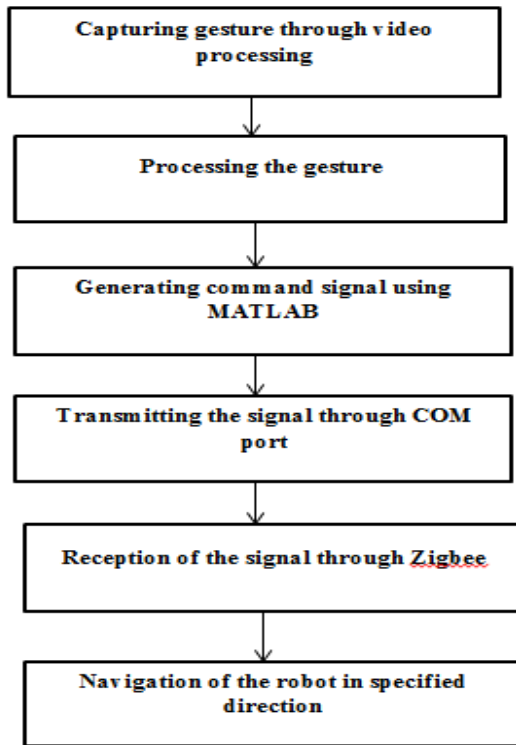


Fig1: Basic flow for developing spybot

The human gestures are converted into signals in order to extract the information embedded in the signal. Hand gestures have been used for controlling the robot. Many systems have been created and implemented in robotic field which use high end equipment and expensive devices to perform gesture recognition operations. Using gesture control operation a spybot is developed that can be helped for secret or silent surveillance. Such silent spy robots can also be used for surveillance in places where the human presence is not recommended.

In this paper a prototype silent spybot is developed whose operation is controlled by using gesture command signals received by Zigbee module. These gesture command signals are generated using MATLAB code.

II. LITERATURE REVIEW

Most of the industrial robots are still programmed using the typical teaching process which is still a tedious and time consuming task that requires technical expertise. Therefore there is a need for new and easier way for programming the robots.

In this paper [1] the gesture based system is incorporated to control the robotic arm. One accelerometer is mounted on the human hand, capturing its behaviour and thus the robotic arm moves accordingly. Robotic arm is synchronized with the gestures and postures of the hand.

Acquiring the input image from camera [2], uses extraction method, features estimation and classification.

Wrong object extraction problem raised if the objects larger than the hand. The performance of recognition algorithm decreases when the distance greater than 1.5 meters between the user and the camera. Besides that its variation to lighting conditions changes and

unwanted object might overlap with the hand gesture. The system is variation to environment lighting changes which produces erroneous segmentation of the hand region.

For real time application [3], the expectation is to obtain the best possible images of the hand gesture with in the lowest possible time. This configuration includes relative position of the hand and the camera.

It uses an active sensor that emits infrared light. The part of the light coming from the lamp passes through the filter. The sensor produces hand images which are highly dependent on reflexive surrounding objects. These objects may cause multiple reflections which do not represent physical object in the reality.

The speech and gesture based interface allows user friendly interaction and can broaden the usability of robots [4]. The user controls the robots by just giving arm directions. The system is developed and implemented with many types of gestures and speech commands.

The outdoor sunlight causing poor depth image generation. The voice synthesizer takes some time to produce the first audio output.

Accelerometer sensor is used for gesture recognition [5]. Microcontroller read data from accelerometer and convert them into digital from which is used to control the system. The accelerometer sensor is mounted on the hand.

Carrying extra circuitry on the hand involves attaching number of accelerometers, there may be loose connections in the system. Hand gesture recognition using image processing algorithm many times involve used to color glove. A data glove is a type of glove that contains fiber optic sensor embedded in it to recognize the finger movement [6].

In this paper [7], it uses a combination of accelerometer and gyroscope and readings are taken for analyzing the gesture. Here accelerometer is dedicated for collecting translational dynamic and static change in positional vector of hand.

In this paper [8], algorithm used to study the features of hand. There are many papers where training of hands using a large database of near 5000-10000 positive and negative images are considered. But this procedure is very time taking process.

III. GESTURE SIGNALS

The Objective of the gesture recognition is to identify the number of fingers in a hand gesture. This recognition system basically worked in the field of service robotics. After modeling and analysis of the input hand image, gesture classification method is used to recognize the gesture recognition process affected with the proper selection of feature parameters.

Gesture can originate from any bodily motion or state but commonly originate from the face or hand current focuses in the field include emotion recognition from face and hand gesture recognition gesture. Recognition can be used to understand the human body language which enables humans to communicate with the machine and interact naturally without any mechanical devices.

The gestures are captured by camera. The technical details of MATLAB commands used for gesture signal processing. A video input is taken from the laptops webcam. This video input is divided into a stack of frames. This each frame is analyzed to get information about the gestures.

Controlling the robot using gestures considered as one of the interesting applications in this field proposed a system that uses the numbering to count the five fingers for controlling a robot using hand pose signs. The orders are given to the robot to perform a particular task where each sign has a specific meaning and represents different functions for examples “one” means “move forward”, “five” means “stop” and so on.

IV. HARDWARE

The circuit diagram of the transmitter and receiver section of the wireless gesture control robot is shown in figure.

Transmitter:

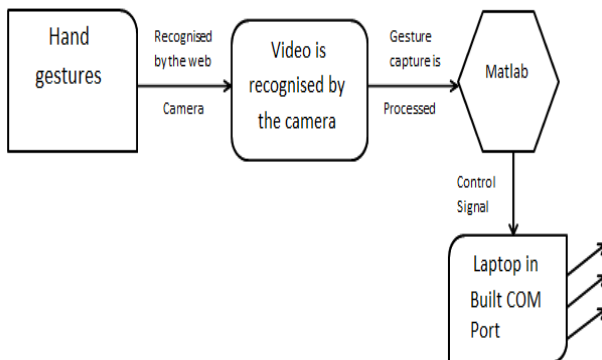


Fig2: Block diagram of transmitter unit

Capture the image through web camera. Process the gesture using various algorithms. Generating command signals using MATLAB transmitting the generated signals through COM port.

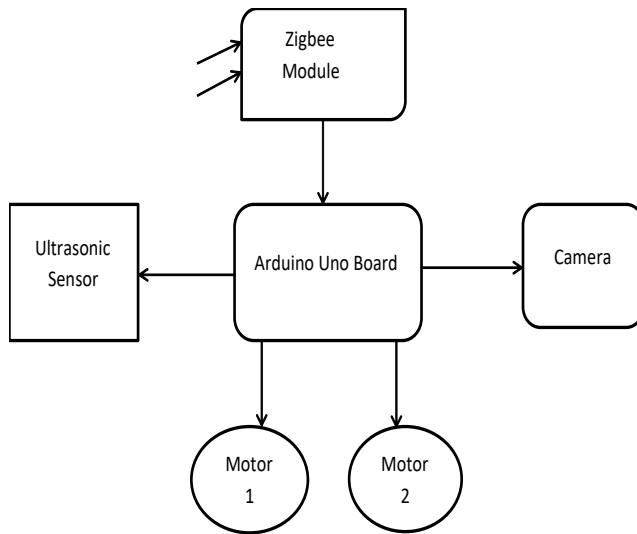
Receiver:

Fig3: Block diagram of receiver unit

Reception of the signal by on board Zigbee module. Spy robot process the gestures and move in the desired direction.

The above receiving block diagram indicates the receiver section the transmitted data by the transmitter is received by the receiver. Depending upon the data received the controller generates signals to the motor driver. Motor driver is to drive the motors L293D IC is used to drive the motors

ATMEGA328P is a single chip microcontroller from Atmel and belongs to the mega AVR series. The Atmel 8-bit AVR RISC based microcontroller combines 32kb ISP flash memory with read while write capabilities, 1KB EEPROM, 2KB SRAM, 23 general purpose I/O lines, a serial programmable USART , 10-bit A/D converter.

V.SOFTWARE

The software program is written in Arduino programming language. We programmed a ATMEGA328P microcontroller with the help of Arduino IDE and an Arduino Uno board.

Basic gesture commands

(a) Move Forward



(b) Move Right



(c) Move Left



(d) Move Backward



(e) Stop

First we have to load boot loader code into the microcontroller. For that we used to Arduino Uno for in system programming (ISP) given in the IDE by selecting file → example → Arduino ISP. Once the boot loader is uploaded into the microcontroller. The code of this project can be uploaded.

VI. IMPLEMENTATION

The command signal sent by MATLAB code through COM port are received by Zigbee module, connected to the Arduino board.

The Arduino microcontroller is pre-programmed to respond to these gesture command signals and activate the respective DC motors. Some of the controls given to the robot is listed below.

1. Move Forward.
2. Move Backward
3. Turn Left
4. Turn Right
5. Stop.

Also, Safety of the robot operation can be ensured by adding features like '*Obstacle avoidance*'. That can provide necessary information about the robots surrounding. Sensors of various types such as Ultrasonic sensors, infrared sensors and optical camera can be used for this purpose. This robot works using Ultrasonic sensor which is particularly chosen, since these have low cost and high ranging capabilities. Thus, whenever obstacle occurs, this sensor senses it.

A wireless camera is placed at the front side of the robot. Data from the camera is accessed by connecting it to the host computer. Thus the spy robot can give real time data about the places to which it can travel.

VII. CONCLUSION

This project proposed work here is an authoring method capable of creating and operation controlling motions of surveillance and industrial robots based on hand robot interaction. The proposed methodology adopted is user- friendly and eliminates intrusion and facilitates motion control of robots using finger signals, which is supplement only to language in the sense of means of communication. In this research work, we have presented a real-time algorithm to track and recognize hand gestures for human-computer interaction with the surveillance robot in context. It has been proposed an algorithm based on hand segmentation, then its tracking and posture recognition from extracted features of hand. The experiments have confirmed that with environmental factors in control it results in higher efficiency and thus, better product development and application oriented concept.

VIII. FUTURE SCOPE

In our system of gesture controlled robot, we have only considered a limited number of gestures. The gesture recognition of our algorithm is too simple and would need to improve if this technique would need to be used in challenging conditions.

Our system has shown the possibility that interaction with machines through gestures is a feasible task and the set of detected gestures could be enhanced to more commands.

In the future, service robot executing many different tasks we can drive our robot in heavy traffic using hand gestures.

As the technology connecting gesture-based control systems improves, more features could be added to the car. Not only could hand and leg movements be detected, but a slight head movement could also be mapped to perform a certain function.

IX. REFERENCES

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