Gesture based Controlled Robot

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Abstract: The Sixth Sense Technology is a method of teaching a machine or a computer to recognise and perceive real-world items and respond appropriately. Sixth Sense technology connects the physical and digital worlds by upbringing the intangible digital data into the real world and which allows us to interact through natural hand gestures. Computer vision, augmented reality, gesture recognition and radio frequency identification are used to implement Sixth Sense Technology. It's a new concept that allows users to connect to the internet without interruption. We can easily access, update, and move data without using a keyboard or mouse. Various technologies have been used to develop new ways for humans and robots to interact. The device is based on the principles of image processing and gestural recognition. Gestures are a popular approach to control the robotic vehicle and improve the interface. The user does not require to make physical touch with the gadget to engage in this interactive technique. It aids in bridging the interactive system's technology gap. The robotic vehicle is controlled in this project by recognising real-time gesture commands from the user, which is accomplished utilising image processing algorithms and embedded approaches.

Keywords: Gesture, Robot, Arduino uno and L239D Motor driver, DC motor, Camera, Laptop, Tracking ball.

1. INTRODUCTION:

The 21st century is completely reliant on technology. Technology has been important in many areas, including education, health, finance and the corporate sector. Because the technology we are using is continually developing and innovations are happening all the time in the today's world at any given time. Thus, day by day the size of the computer devices are getting reduced. Sixth Sense Technology is one such innovation. Steve Mann, who invented the neck-worn computers in 1997, is credited with being the brains behind this technology.

A PhD student at the MIT Media Lab, Pranav Mistry, who is the Vice President of Research at Samsung now, continues this study. These five senses are used to perceive information around humans in terms of touch, vision, taste, smell, and hearing. Thus, the most vital information, namely data available on the internet, is not normally recognised by the human senses; yet, such information will be readily available with six sense technology as the boundary between digital and the physical worlds closes, people will have more options. Sixth Sense technology will alter the world in every way; actions that currently take several minutes will be completed in a matter of milliseconds thanks to the sixth sense technology.
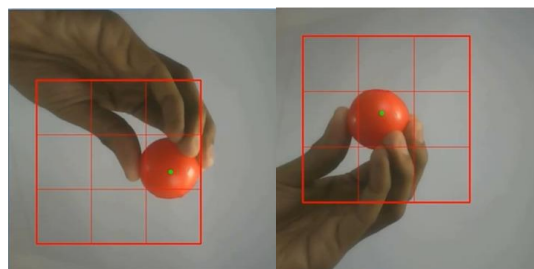
With the use of this technology, people would be able to utilise computers at anytime, anyplace, turning the entire world into a computer. Arduino basics, Arduino architecture, H-bridge, DC degraded motors, Bluetooth modules, and other topics will be covered in this project. We'll develop LED scripts for the robot to generate signals that will be used as output or input. Then comes the assembling the robot. We used MATLAB, computer vision, Python, and other tools to put it together. Each component cooperates with the others to carry out a specific function for which it was designed.

2. SIXTH SENSE TECHNOLOGY'S MAJOR BUILDING BLOCKS ARE AS FOLLOWS:

2.1 Camera
This part is located on the front of the Sixth Sense Technology system. The working of the camera is identical when compared to a human eye, with the exception that it will deliver digital data. The camera can capture photographs that fall within its field of view, as well as provide information about the objects in front of it.

2.2   Arduino Uno

Arduino is an open-source electronic device or an integrated circuit board that makes it easy and simple to use by using minimal usage of hardware and software. Arduino boards supports inputs from various sensors and translate inputs like light sensing, a finger recognition, or a Twitter post into outputs like lighting an LED, starting a motor, or publishing anything online on the web.

2.3   Arduino UART Cable

This is a part of hardware for computers which is called a UART (Universal Asynchronous Receiver-Transmitter) that allows us to customise the data format and transmission speeds for asynchronous serial connection.

2.4   DC Motors

These motors are used for the movement of the robot. It provides the power to the wheels of the robot for the movement in multiple directions.

2.5   L239D Motor Driver

This is a motor driver IC with the ability to drive dual motors at the same time. L293D is an integrated circuit with dual H-bridge motor driver which gives a precise control over the motor. A bidirectional dc motor can be operated using a single H-bridge. The L293D IC is a current boosting IC that is used because the output from the sensor is not capable of driving motors on its own.

2.6   Wheels, Screws & Nuts, Wire Strippers & Screwdrivers, Robot Chassis
These are the mechanical parts which are used to design and build the robot.

2.7   Cable & Connectors
These are used to connect the required ports in Arduino Uno board and the motors drivers.


3. SOFTWARE USED:

3.1 Python IDE
This is an IDE which uses python programming language. It is a programming language that is generally used to create websites and applications, automate operations, and perform data analysis. There are multiple python IDEs which are open source and can be used for programming such as PyCharm, IDLE and Jupyter Notebook.

3.2 Arduino IDE-
It is an open-source IDE which is used for writing and uploading code to Arduino boards. The programme written in this IDE is compatible with many operating platforms, including Linux, Windows, and Mac OS. It supports a variety of programming languages, including Python, C, and C++.

4. METHODOLOGY

For gesture recognition, the system requires live streaming from a webcam. At regular intervals, the frames are taken. The frame rate captured for the gesture is around 2 frames per second. This approach is further subdivided into the sections below:
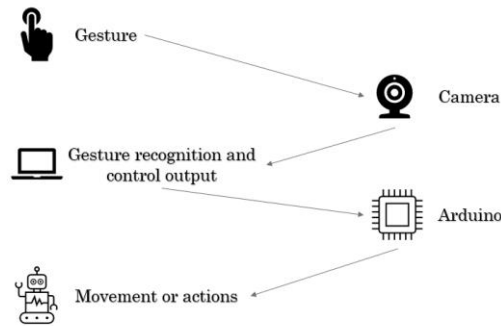
## 4.1 Capturing the movement of tracking ball through live stream.
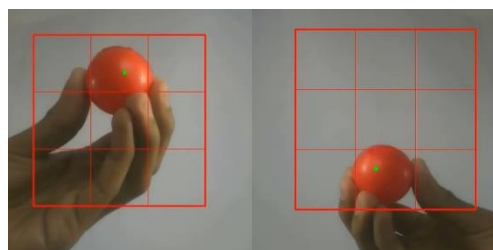
## 4.2 Converting the image captured into suitable format (with the help of MATLAB).
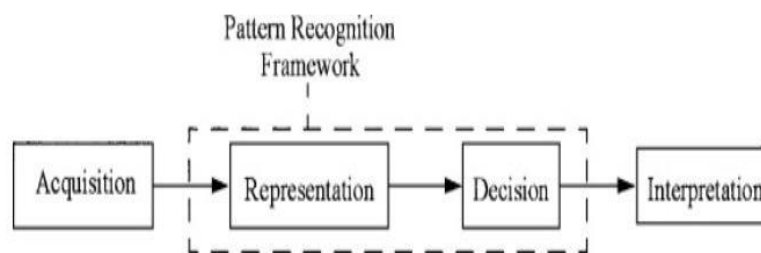
4.3 Comparing the captured image with the live streaming image samples and processing the image with the help of HOG (Histogram of Oriented Gradients) algorithms

In computer vision(CV) and image processing, it is an feature that describes object detection. This technique counts events that have a gradient orientation in a certain area of an image or region of interest and SVM (Support Vector Machine) which woks on supervised learning algorithm or image processing algorithm which is capable of performing regression, classification and even outlier detection in any image.
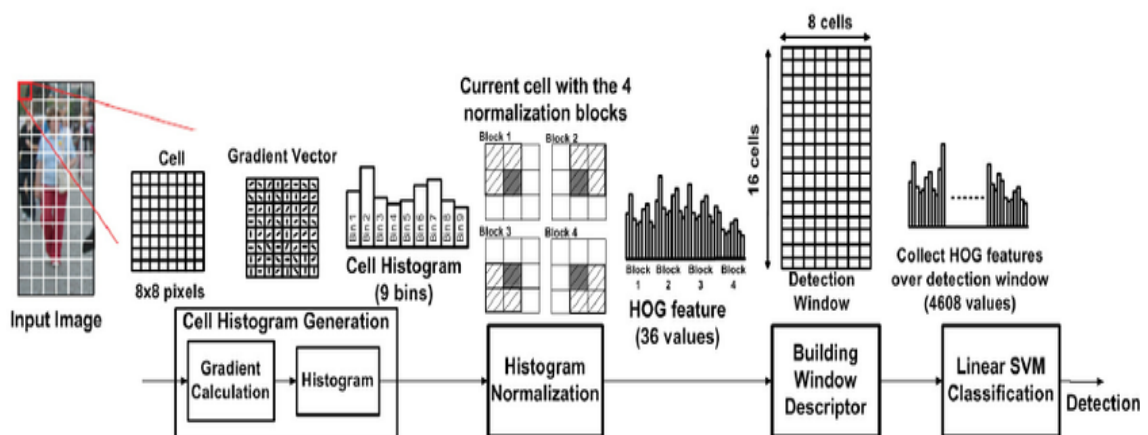
4.4 Generation of command signal through Robot
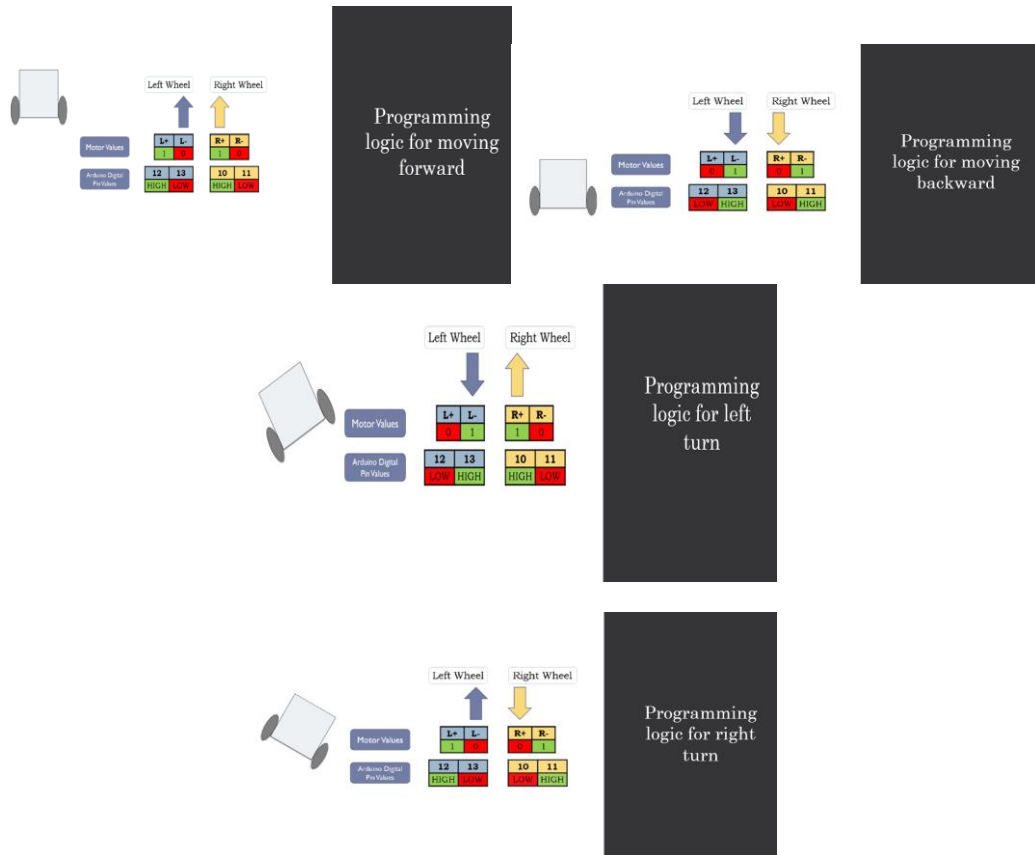
5. FUTURE WORK AND APPLICATIONS

Robotics has advanced quickly, and today, they are utilised in a wide range of fields, including:

5.1 Defence purpose

This can be used as a surveillance robot to track down opponents or assist the police with location. Due to their tiny size, portability, and ability to reach disruptive locations.s

5.2 Wheelchairs

People with disabilities could utilise a gesture-based wheelchair to reduce their dependence on others.

5.3 Household

Gestures could be used to operate a variety of home appliances without the usage of a switch or socket. Also, these gesture based controlled systems could be used for entertaining purposes such as playing 3D games, play stations.

5.4 Medical Field

The touchless interfaces could be quite useful in several medical fields such as patient surveillance and for monitoring.

5.5 Industrial

Many machineries such as arms, trollies etc. Which could be controlled by the help of gestures made by us. Essentially, programming could be used to install automated gadgets that can be controlled using gestures. The method has enormous potential for use in a variety of fields. By the use of improved specifications of the microcontrollers their work could be updated and also the system performance can be upgraded. The system work can be improved with the use of better and efficient wireless communication techniques.

6. CONCLUSIONS

Various works have been completed to operate the robot. In this research, image processing with machine learning and python programming, Arduino with the help of Arduino programming tools was used to operate a robot via gestures, as it provides efficient and faster methods for extracting features and providing a better user-friendly interaction. The study discusses the most cost-effective robot controlling technique (through a software and PC). It just takes one hand to

perform all the gestures created by the technique, hence neither hand is needed, this makes it beneficial for physically challenged people. It also abolishes the requirement for a person to control the robot from beside it.
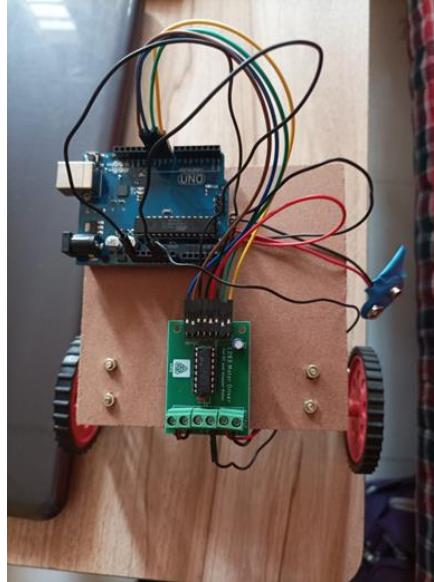
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