Control buggy using Leap sensor camera in Data Mining Domain.

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Abstract - *This paper portrays a method for controlling the buggy with proper gestures utilizing the leap motion camera. We have used leap as motion controller and the operation is completed on a buggy. The proper gesture for the action to be performed is accumulated in the database, when the gesture is performed five points are extracted from which fifteen features are selected and this fifteen features are further used for comparison with stored gesture using similarity algorithm and the proper gesture identified by the system which is further performed by the buggy. In this system we are going to develop a buggy having two Direct Current motors connected to microcontroller via device driver. The micro-controller is affiliated to the PC by Max 232 serial communication wire. The above mentioned system diminishes the human efforts while driving a car in real life (buggy is considered). This paper does not make driving 100% automatic but it reduces the efforts to a greater extent elevates the efficiency of the system.*

***Key Words*: Leap motion, gesture, Euclidean distance, cosine similarity, Trajectory feature, gesture recognition**

1. INTRODUCTION

Now days the use of community transport like car has increased a lot in last few years. People send most of their energy driving from one locality to another, short as well as long distance. So to reduce the efforts required by the human being this system is designed. In our case gesture is used to control the buggy/car. Gesture is the movement or action performed by body/limbs/hands to express certain idea or sentiments. In simple words gesture means talking with hands. The capturing of the gesture is carried out by different devices in our case leap camera controller is used for gesture recognition which are performed by hand and this results in the motion or controlling of the buggy by gestures of human hand.

In order to send the correct gesture to the buggy the system requires some device that could scan the image of gesture. The leap camera is utilized to capture the actual gesture performed by the human being in other words leap is just a simple device that provides input to the system. The heart of the device consists of two camera & three infrared LEDS. It can track wavelength about 850 nm outside visible light spectrum. The viewing range of the device of the device is 2.6 feet. The data is in gray scale from which is separated into left & right cameras.

As soon as the image data is streamed to your computer, the mathematical calculation takes place. The leap motion service is the software present in the computer that processes the image

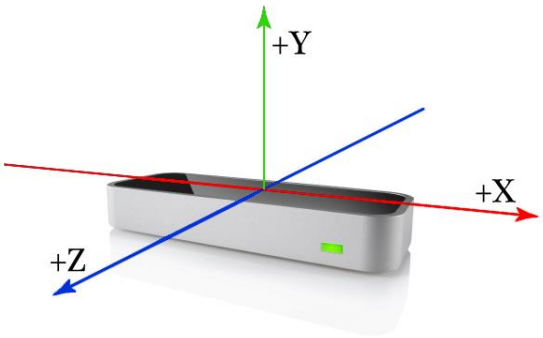

Fig 1: Leap Motion coordinates.

2. Literature Review

Gesture Control of Drone Using a Motion Controller [1] provide an easy way to interact and communicate with machine. The human gesture or actions are applied to interact or to control the AR Drone .The actions done by the drone are lifting, moving and yawing. It also perform movements for flips, python script is used for flip. . The Leap Motion Controller uses its two monochromatic infrared (IR) cameras and three infrared LEDs to identify any gesture performed above the leap to a distance of 1 meter or 3 feet directly above the leap. Means it creates a hemispherical area around it which is about 1 meter and recognize any hand gesture in that volume.

A lot of analysis work is completed in recognition of leap gesture. Several techniques are planned for recognition of hand gestures. During a Gesture Guided Moving mechanism with Microsoft Kinect [2]: demonstrate a gesture-guided mechanism moving system that is controlled by human gestures and keep step with the controller with comparatively constant distance. They used 2 advance devices programmable mechanism system: iRobot [1] and Microsoft Kinect [2]. Some straightforward gestures will be accustomed build the mechanism move any, closer, and keep step with the walking person.

Application of hand detection algorithm in robot control [3] presented the concept of vision based robot control system .The hand detection algorithm in controlling robot presented a robot control system which is vision based. To control the robot manipulator hand gesture tracking and detection algorithm is used. The points and their paths are converted into a set of orientation and location value so as to achieve appropriate motion of manipulator. The drawback is that for accuracy we need to provide appropriate.

Indian Sign Language to Forecast Text using Leap Motion Sensor and RF Classifier its proffered system involve

recognition of Indian language (ISL) exploitation Leap Motion sensing element. The device extracts vital characters/ attributes from the dataset such high-accuracy angle between fingers cab be retrieved, and this could be used for sturdy prediction. Feature classifier is employed to spot that gesture is being performed. Here, Random Forest (RF) classifier model is employed as feature classification. A block-list classifier is employed to get rid of all non-gestures frames, when that correct gesture frames area unit recognized by RF to create a significant word. This significant word is then displayed on digital display. Downside of this analysis is every country and every region has its own language, therefore this model is beneficial for less than individuals who now the Indian language.

The motion controller's internal elements could be a 2 camera digital to find the motion of the hands and fingers and a 3 LED's infrared for detective work the space between the user's hands with the leap motion controller, to find the space for controlling the automaton arm. Mainframe within the LEAP motion controller is processing visual information. It then sends the info of the movement of the hand and fingers into the pc. The information are formatted data on the space and the position coordinates of the hand and fingers at the moment send to the microcontroller for signal process and send management commands to drive server motor to manage the robotic arm. This technique carries with it four main parts:

- The signal detection consists of a Leap motion controller
- The signal processing part using JavaScript and node.js
- Microcontroller
- The robotic arm

3. Proposed System

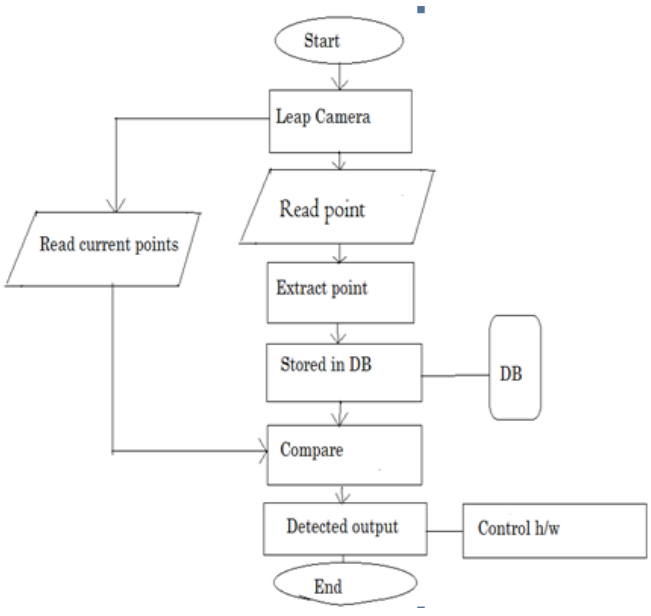

Fig 2: Flow chart

We have proffered a system which identifies the gesture done by the user which is detected by the leap motion camera and the appropriate gesture is performed by the buggy. In this system 6 points are extracted from the gesture done above or incident to the leap motion camera. From these 6 points the features required for detecting the gesture are calculated. In the previous system only 12 features were identified in this system total of 15 features are selected making the system more efficient. The proffered system is partitioned into 4 main steps:

1. Leap interfacing

2. Preprocessing and point extraction

3. Feature extraction

4. Feature comparison

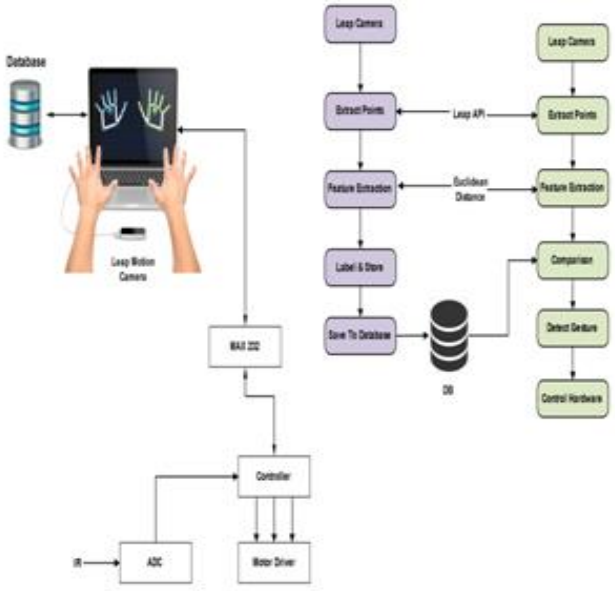

Fig 3: Block diagram

1. Leap interfacing

The software used for leap motion runs as a service of window system. The leap motion services are accessed by leap enabled application for the sake of receiving the data, leap motion SDK contribute 2 API which are

a) Native interface
b) Web socket interface

a) Native interface :
It is a set of small programs that can be loaded whenever needed (dynamic library) which is used to compose new leap enabled application.

b) Web socket interface :
The web socket interface & JavaScript client library are together used to develop leap enabled web applications.

2. Preprocessing and point extraction

Initially the features for the appropriate gesture and the action to be performed are hoarded in the database as the dataset for future recognition. As soon as the gesture is done by the user in front of leap camera. Extraction of the 6 points take place these 6 points indicate the centroid of the five fingers which are thumb, index finger, middle finger, ring finger & the centroid of plan.

3. Feature extraction :

The features required for the system are extracted from the 6 points in order to analyze the action to be performed the features are selected total 15 features are selected for appropriate identification of action to be performed, the extracted features are actually the distance between all points. The 6 points are p1(x1, y1, z1).....p6(x6, y6, z6) to find the distance between points Euclidean distance formula is applied:

$$d(\mathbf{p},\mathbf{q}) = d(\mathbf{q},\mathbf{p}) = \sqrt{(q_1 - p_1)^2 + (q_2 - p_2)^2 + \cdots + (q_n - p_n)^2}$$

$$= \sqrt{\sum_{i=1}^{n} (q_i - p_i)^2}.$$

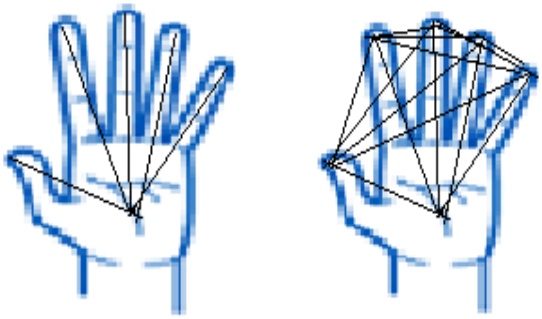

Fig 4: Points extraction

4. Feature comparison

Once the 15 features are selected for each gesture a value is calculated for this. Then the current value is compared with the features in the dataset the value which is near the value of the current gesture is the gestured action which is to be performed. In order to compare and find the appropriate action for the gesture the cosine similarity formula is used which is

$$\text{similarity} = \cos(\theta) = \frac{\mathbf{A} \cdot \mathbf{B}}{\|\mathbf{A}\|_2 \|\mathbf{B}\|_2} = \frac{\sum_{i=1}^{n} A_i B_i}{\sqrt{\sum_{i=1}^{n} A_i^2} \sqrt{\sum_{i=1}^{n} B_i^2}}$$

Where and are components of vector and respectively.

Gestures	Distances	value
G1	D1, D2, D3, ..., D15	K1
G2	D1, D2, D3, ..., D15	K2
.	.	.
.	.	.
.	.	.
Gn	D1, D2, D3, ..., D15	Kn

Table 1: Stored gesture

Unknown	D1, D2, D3, ..., D15	K

Table 2: Current gesture

Approximate value found and gesture is identified

4. HARDWARE USED

1. ATmega32

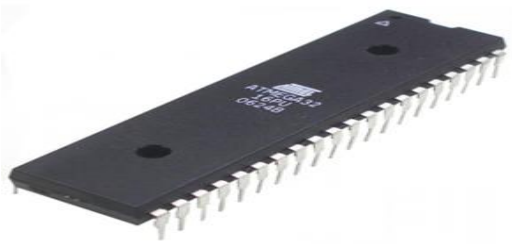

Fig 5: ATmega32

ATmega32 is an 8-bit a sophisticated microcontroller of Atmel's Huge AVR family. Atmega32 is dependent on increased RISC architecture which consist of 131 powerful instructions. Almost all of the instructions execute in one instruction cycle. Atmega32 can work s on the maximum periodicity of 16MHz.

2. MAX232

Fig 6: MAX232

The MAX232 IC is utilized to convert the TTL logic levels to RS232 logic levels during serial communication of microcontrollers with computer. The controller operates At TTL logic level (0-5V) the controller works whereas the serial communication in computer works on RS232 standards (-25 V to + 25V). This makes it challenging to create a direct association between them to interact with each other.

ULN2803

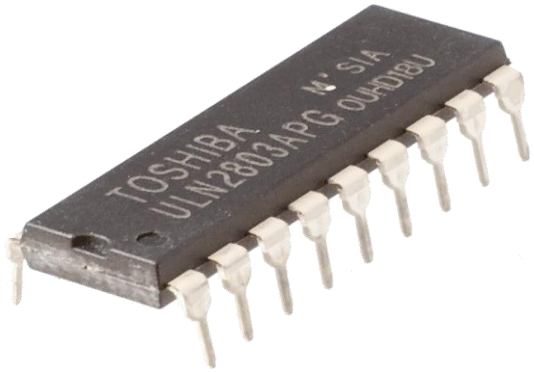

Fig 7: ULN2803

ULN28xx high voltage, excessive-cutting-edge Darlington arrays are used for interfacing among low degree logic circuitry and a couple of peripheral power loads. Some of the loads are solenoid, magnetic print hammers and heaters. All the devices have feature open-collector outputs with integral clamp diodes.

3. Sensor used (IR Sensor)

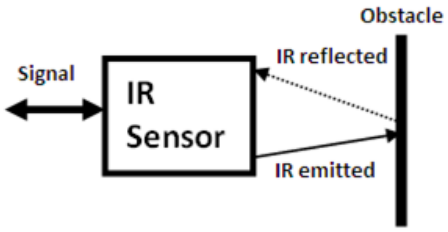

Fig 8: IR Sensor

The IR sensor is a tool which detects IR the radiation falling on it. There are several types of IR receptors that are built and can be built with respect to the application. Proximity sensors (Used in mobile phones and Edge Avoiding Robots),contrast sensors (Used in Line Following Robots) and blockage counters/sensors (Used for keeping track of goods and in Thief Alarms) are some illustrations, which use IR sensors.

Every sensor in this world has three ports:

- VCC - to switch on the sensor
- GND – to set negative reference
- Output - analog output of the sensor(in some receptors , there may be more than one output terminals)

In this system the IR sensor is used to detect the obstacles in front of the buggy/car.

5. CONCLUSIONS

We have proffered a framework to control buggy using hand gesture. In this study we have utilized hand motion dataset that includes numerous gesture representations. We have utilized leap motion sensor camera to observe hand motion. To compare current gesture with stored gesture we have extracted a feature set. The features are calculated using Euclidean distance formula. This feature set will be compared with stored data using cosine similarity and buggy will take appropriate action.

In this study we have utilized 3D leap motion sensor camera and we have extracted features of hand or fingers for maximum accuracy. For detecting gesture in 3D we can use AI based algorithm for further study

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