© 2019 IJSRSET | Volume 6 | Issue 1 | Print ISSN: 2395-1990 | Online ISSN : 2394-4099
Themed Section : Engineering and Technology
DOI : https://doi.org/10.32628/IJSRSET196170

An Intelligent Human-Machine Interface for Robotics Control

Navya Raj*, Hetal Verma, Kanishk Sharma, Manish Kumar, Prof. S G Desai
Electrical Engineering, Bharati Vidyapeeth (Deemed to be) University College of Engineering, Pune, Maharashtra, India
Corresponding author : Email Id - navyaraj2599@gmail.com

ABSTRACT

(HCI) which is termed as Human Computer Interface is very essential in enhancing the performance and efficiency of robot control to complete the complex tasks. It is worthwhile to develop recognition methods by virtue of which a computer will be capable of controlling human's repeated actions effectively. Thus in aforementioned paper, we have generated a CG (Computer Graphic) model to characterize the motion response from the sensor. We propose to explore other manners of human-computer intercommunication like automation & navigation. The primary idea for this paper is to analyze how to improve HCI systems thereby bettering human machine work criterion. The results indicate that the human robot interface based on motion recognition can push comparable needs to different users adequately, which provides a new approach for the association between robots and human.

Keywords: Computer graphics, Human Computer interface, HMI, Robotics

I. INTRODUCTION

Undoubtedly, Human-Computer Interface is a technique for better divulgence between humans and computers. As humans are the executants of the work or the commandment therefore the computer is referred to a machine which works on stipulation of humans. The Human-Computer Interface constitute of humans, computers, interface, and more importantly the domain in which system is established.

In today's modern era, no doubt the connections among humans and computers have become an important aspect. In the early days of fledgling technology communication via simple panels and boards, display units and alternative devices with distinguishable endowment such as voice recognition, tracking devices, identification through biometrics are what prevail to the framework of a felicitous interface for intercommunication in the midst of humans and computers.

Human Machine Interface (HMI) has always been a territory of study committed to understanding, designing, and assessing robotic systems for use by or with humans. In the past few years the growing discipline of Human machine interaction has captivated a lot of attention. Therefore, frequently expanding the whack of robots and users engrossment to such robots in their customary lifestyle making this an affectionate one.

Nowadays, Robotics has become a dynamic branch of science and technology that comprehend innumerable engineering range like mechanical, electronics, electrical, computer science and many others. For the benediction of the humankind the construction, operation and design of robot has been done with the robots involvement. These mechanization are used to develop machines that can become the trade for humans and human behaviour. Robotics can be passed down for any objective and in any situation. Basically anything a human can do like walking, lifting, speech, cognition can be delineated through Robotics.

Researchers are these days being fascinated and motivated to grapple the enclosure of HMI. Interested roboticists, engaging themselves on advanced robotic systems to develop real life applications out of it. In 1960's with the creation of Robots for Industrial purpose was deliberately strided into people's habitat in different aspect, like production in industries, regular use, zone inspection and many more.

In the paper "Human-Computer Interaction: Process and Principles of Human-Computer Interface Design" the author 'Gong Chao' at the 'Computer and Automation Engineering conducted an International Conference' which encapsulated interpretation of machine-human organization and computer-human communication, and scrutinizes the different methodology of computer-human interfacing. This paper has its own primitive ideologies which help in elucidating how to rehabilitate the machine-human ideologies, and create machines to work skilfully for humans and have a harmonious relationship with the environment [1]

In the paper "Design of Human-Robot Interactive Interface based on Identity Recognition" the author 'Pu AI', 'Qi-Jie ZHAO', 'Zhen-Nan KE', 'Chun-Hui HUANG' and 'Jin-Gang YI' discusses about developing an easy going human-robot interactive interfaces for users based on identity recognition. By recognition of face it determines the user identity, and then a better personalized solution is suggested by the robot to the user for better solutions [2]

In the paper "Tools for Programming Human Robot Interaction" the author 'James P. Diprose' on 'Visual Languages and Human-Centric Computing' at 2014 IEEE discussion recommended the idea of application programming interface. The Robot-human interaction programming tools are offered on this platform for its users which is also capable of programming and laying the groundwork for a dynamic range of human-robot interaction. They developed an epitome high level software interface for programming at social level and figured it out with the intellectual ambit of the groundwork. The author also explored other fields of communication between a human and a robot like navigation as well as how it needs to be effectively implemented with actual elementary calculation of various social interactions [3]

In the paper "Human-Computer Interaction: The Usability Test Methods and Design Principles in the Human-Computer Interface Design" the author 'GONG Chao' deliberated about the usable outline for human computer interface. The authors also determined the market value of the product they produced. Designers made mutual innovations for using the product in different ways by utilizing natural and human ideas efficiently. Through this way of innovation, the growth directions is made for users' and product functions is rightly guided for betterment [4]

In the paper "Introducing Human-Computer Interaction:
A Didactic Experience" the author 'Paolo Rocchi' provided information of an experience of a professional course for designing an interface with technical details. In some special lectures on interaction in humans and robots we were introduced to some assumptions about the behaviourism of

computer users. The aim of the lessons was to unfold the difficulties; they enhanced the professional skills of students and provided us with a deep understanding of user-centered design methods in HCI [5]

In the paper "Humanoid Robot Operation by a Brain-Computer Interface" the authors 'Jingsheng Tang', 'Jun Jiang', 'Yang Yu' and 'Zongtan Zhou' at the 2015 7th International Conference on 'Information Technology in Medicine and Education' the author presents a Brain-Computer Interface. The Brain-Computer Interface (BCI) provides a communication channel between human and external devices which is user friendly and also stimulates the brain activities directly to the computer commands. In the paper, a real human robot was controlled by P300 an event-related potential (P300) based on BCI environment. This study also depicts that it can be further be utilized as a potential technology applied for improving aeronautics and other applications as well [6]

II. MOTION SENSOR

As a fundamental and crucial term Robotics control, is the assimilation and execution of controlling robots. This paper is the most helpful application of Robot Motion planning. It is the concept which is used in robotics for the operation of deciding the desired movement problem into distinct motions. The most fundamental and vital expression in the interconnecting representation, feasibility is a general status of the level of use in the HCI, which proves the identification of the interconnection. It is a standard form to assess for the consumers whether the product is understandable or not.

On behalf of application of human computer interface (HCI), this paper is described by the support of H-M interface for robotic control. We make use of following hardware equipments which are as follows:

1. Arduino UNO board
2. Male to Female jump wires
3. Male to Male jump wires
4. GY-87 Sensor

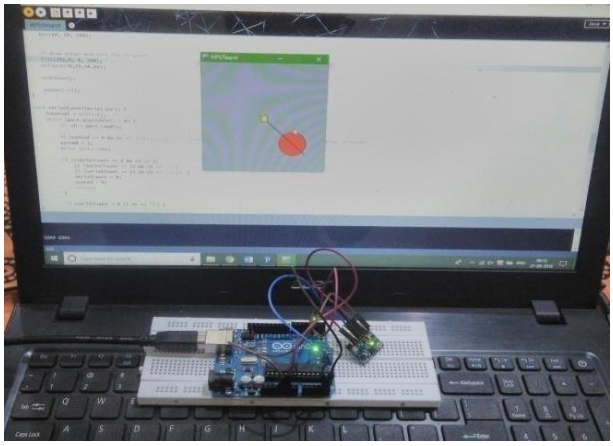

Fig 1. Snapshot of the project model

Arduino Uno Board

The Arduino UNO board is a popular open source microcontroller based on the Microchip ATmega328P microcontroller. Developed by Arduino.cc, the board consists of input/output (I/O) pins that may be interconnected to various expansion boards and other circuits for digital and analog signals.

Some of the specifications of this board are:

1. Microcontroller: Microchip ATmega328P
2. Input Voltage: 7 to 20 Volts
3. Operating Voltage: 5 Volt
4. Analog Input Pins: 6
5. Length: 68.6 mm
6. Digital I/O Pins: 14 (of which 6 provide PWM output)
7. Flash Memory: 32 KB of which 0.5 KB used by bootloader.
8. DC Current for 3.3V Pin: 50 mA
9. SRAM: 2 KB
10. EEPROM: 1 KB
11. Clock Speed: 16 MHz
12. Width: 53.4 mm
13. Length: 68.6 mm
14. Weight: 25 g

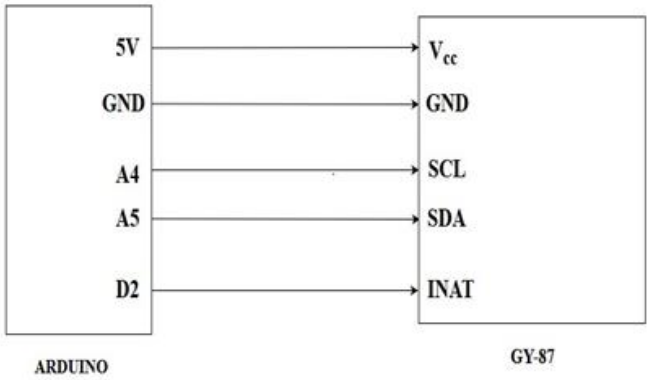

Fig 2. Circuit Diagram

Here in the fig 2 circuit diagram of the model is shown. It shows the connection between the Arduino Uno and the sensor GY-87 where the pin of the Arduino is connected respectively to the sensor's pin.GY-87 has total of 8 pins out of which we have made used of only 5 pins which include SCL, SDA, V_{cc}, GND, INAT, SCL stand for serial clock line, SDA stands for serial data, and INTA stands for interrupt from accelerometer.

GY-87 10DOF Sensor

These sensors are used for the Acceleration, Gyroscope and Magnetometer. 10 DOF modules consist of three-axis gyroscope, tri axial accelerometer, three-axis magnetic field and atmospheric pressure all based on the sensors MPU6050, HMC5883L and BMP085. The sensor MPU6050 is the first unsegregated 6-axis Motion Tracking device that amalgamates a 3-axis gyroscope, 3-axis accelerometer, and a Digital Motion Processor (DMP). The Honeywell's HMC5883L is a 3-axis digital compass. To detect barometric pressure and temperature the most accurate chip we could use was BMP085. It is acceptable for most of the controlling system.

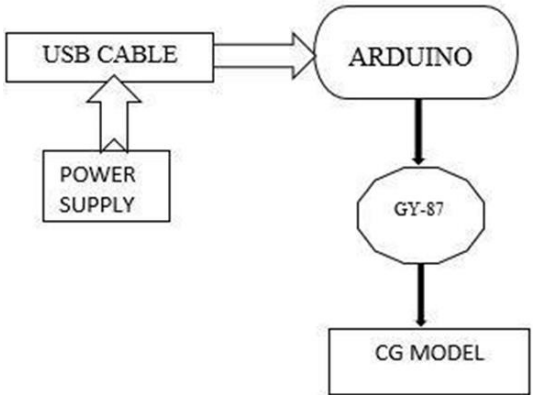

Fig 3. Block diagram of the model

The above diagram shown in the fig.3 is the block diagram of our project model which shows the step wise process of our model.

A great combination of a 3-axis gyroscope and a 3-axis accelerometer, the MPU-6050 placed on the same silicon die together with an on board Digital Motion Processor (DMP), which processes complex 6-axis Motion tracking devices. These Motion Tracking devices are designed for the low power, low cost, and high-performance requirements of smart phones, tablets etc these motion tracking devices are of great use.

Now 3D visualization of this motion sensor is facilitated with the Processing software. A special library named "Toxi" for processing purpose was downloaded and introduced.

In order to visualize the 3D visualization, we had first uploaded the Arduino code for MPU-6050. We changed String port Name to the port on which our Arduino is connected.

For windows users, comment this code as: //String port Name = "/dev/ttyUSB1";
Likewise, uncomments this code as: //String port Name ="COM15"; by String port Name ="COM15";
We replace "COM15" with the COM port on which our Arduino is connected. So, finally the setup was completed and the Arduino code was uploaded (MPU6050_DMP6) through Arduino IDE. Then the

processing code (MPUTeapot) by run by pressing the button with "play" symbol, after which, a 3D model was presented and was moving accordingly with the MPU-6050 sensor.

Processing

Wide asset software providing us with source code editor, automation tool and a debugger is often known as Processing, which is used by the different visual designing communities and other users for designing electronic arts and media art. The main focus is given to the non- programmers for teaching them the fundamentals of computer programming which is more pleasing in a visual context. With some additional simplifications such as more classes and mathematical functions and operations, processing software is easy to use for its users even though it uses java language. With a graphical user interface for simplifying the compilation and execution of the program, processing makes it very visually appealing for its users. Casey Reas and Ben Fry originally worked on this software in 2001. The URL at proce55ing.net was used initially because the processing domain was taken aback. Processing was pronounced the same even after the eerie combination of letters and numbers. Users always find visual content very easy to grasp and that's the reason why this software promotes literacy which is more oriented to visual arts and technology, for making the learning process an interesting journey and even teaching became an easy task. Users like students, researchers, designers etc use processing software for prototyping several projects based on Arduino and Wiring. For penning down our code the version we used was 2.2.1.

Applications

Human interaction with a computer is a very idea of this part. With the development of modern multi-sensory user friendly interface, the field of HCI continues to undergo rapid changes. Applications like smart devices, information processing engine, and large interactive displays have become more invading in this modern world. Three interaction levels: physical, cognitive, and affective has been widely acceptable making our lives simpler and easier. Advanced technologies such as animation and networking are combined with HCI technology which is growing rapidly and will continue to make advancements in this modernizing world.

III.READINGS

Timings	x	y	z
13:18:44:289	-67.67	78.69	-0.75
13:18:44:324	-67.54	78.70	-0.75
13:18:44:364	-67.38	78.70	-0.76
13:18:44:394	-67.17	78.69	-0.76
13:18:44:424	85.33	81.48	-1.51
13:18:44:468	85.35	81.48	-1.55
13:18:44:498	85.38	81.27	-1.48
13:18:44:524	85.39	81.27	-1.47
13:18:44:568	85.42	81.07	-1.42
13:18:44:594	85.42	81.05	-1.42

In the table shown above readings were taken on the real time position of the sensor.

From the above readings we can observe that we have some values of x and z axis as negative, which shows that the values of x and z axis are lying negative side of the reference line.

IV.CONCLUSION

In this paper, a new method of human-robot interaction is proposed, which is based on the motion recognition before cooperation between service robot and human. Tests were carried out in an experimental. The results show that the proposed method can recommend the needs to the users actively and provide a new way of thinking for researchers to continue to study the interaction and cooperation between people and service robots. The

future of human-computer interface design put forward a wide range of challenges for the designers. The new goal of the HCI system is not to force humanity to adapt to a computer system but to make the system serve and adapt to the needs of a person by improving.

V. REFERENCES

[1] G. Eason, B. Noble, and I. N. Sneddon, "On certain integrals of Lipschitz-Hankel type involving products of Bessel functions," Phil. Trans. Roy. Soc. London, vol. A247, pp. 529–551, April 1955. (references)

[2] J. Clerk Maxwell, a Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.

[3] I. S. Jacobs and C. P. Bean, "Fine particles, thin films and exchange anisotropy," in Magnetism, vol. III, G. T. Rado and H. Suhl, Eds. New York: Academic, 1963, pp. 271–350.

[4] K. Elissa, "Title of paper if known," unpublished.

[5] R. Nicole, "Title of paper with only first word capitalized," J. Name Stand. Abbrev. In press.

[6] Y. Yorozu, M. Hirano, K. Oka, and Y. Tagawa, "Electron spectroscopy studies on magneto-optical media and plastic substrate interface," IEEE Transl. J. Magn. Japan, vol. 2, pp. 740–741, August 1987 [Digests 9th Annual Conf. Magnetics Japan, p. 301, 1982].

[7] M. Young, the Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.

Cite this Article

Navya Raj, Hetal Verma, Kanishk Sharma, Manish Kumar, Prof. S G Desai, "An Intelligent Human-Machine Interface for Robotics Control", International Journal of Scientific Research in Science, Engineering and Technology (IJSRSET), ISSN : 2456-3307, Volume 6 Issue 1, pp. 386-391, January-February 2019. Available at doi : https://doi.org/10.32628/IJSRSET196170 Journal URL : http://ijsrset.com/IJSRSET196170

Authors

Navya Raj is an undergraduate student at Bharati Vidyapeeth (Deemed to be) University, currently pursuing her B.Tech in Electrical Engineering. She has a keen interest in automation and robotics and attended various workshops and conferences for the same. Presently, she is undertaking a research in the same domain.

Hetal Verma is a currently pursuing her B.Tech form Bharati Vidyapeeth (Deemed to be) University in the field of Electrical Engineering. Her field of interest lies in the domain of Robotics, Automation and Data Science. She is willing working to gain more experience in the particular field by doing researches and undertaking different courses.

Kanishk Sharma is an undergraduate student at Bharati Vidyapeeth (Deemed to be) University, currently pursuing his B.Tech in the department of Electrical Engineering. His research interests are in the field of artificial intelligence, machine learning and robotics. He pursued an academic internship at NUS, Singapore and his internship topic was on "Artificial Neural Networks".

Manish Kumar is a student of electrical engineering at Bharati Vidyapeeth (Deemed to be) University, College of Engineering, Pune, India. His interests of areas are Robotics, Machine Learning, Artificial Intelligence, Printing Technology, healthcare etc. He published a chapter under International Elsevier Publisher.

Shripad Desai is working as a Assistant Professor in Bharati Vidyapeeth (Deemed to be) University College of Engineering, Pune, India.