ISSN 2319 - 7595
Volume 1, No.2, November - December 2012
International Journal of Information Systems and Computer Sciences
Available Online at http://warse.org/pdfs/ijiscs01122012.pdf

Humanoids Implementation Using Sixth Sense

Nikhil Nadiger
nikhilnadiger@gmail.com
Dept of ISE, UG Student, SET – Jain University, Bengaluru

Madhusudan K
madhusudanka@gmail.com
Dept of ISE, UG Student, SET – Jain University, Bengaluru

Santosh Naik
santoshrcnaik@gmail.com
Asst. Professor, Dept of ISE, SET – Jain University, Bengaluru

Abstract: In the age of automating even the trivial works, we have come across a time where the very nature of human interaction can be revolutionized. All of us visualize a future depicted in the Will Smith starrer "i Robot" where artificial intelligence reaches its pinnacle. Taking a step towards the visualization, this paper proposes combining two technologies viz., Sixth Sense and Robotics to achieve a more efficient and versatile humanoid. Sixth Sense is a wearable gesture interface developed by Pranav Mistry. This integrates the real and the digital world. Simple devices like cameras, mouse sensors etc are used to create an interface and digitalize the world around us. Humanoids are robots which resemble human body in appearance and can imitate the movements of the same. They rely on human-like senses such as vision, hearing and touch along with an extra ability to be more efficient than humans. If we combine Sixth Sense technology's ability to map human physical movements onto a digital interface (say computer) and the ability of Robotics to realize digital data into physical world, a class of human driven robots can be achieved which can imitate every movement of a human. The obvious application of this proposal is in defense and rescue operations. Even the lifting of heavy objects can be made easy. Real life operations such as one in a volatile mine can be realized easily. Also, it can be extended to high profile operations such as space exploration. In conclusion, this class of robots can reach places and efficiency levels which humans can never do owing physical constraints.

Keywords: Humanoids, Sixth Sense, Automation, Pranav Mistr.,Human to robot motion mapping.

INTRODUCTION

Sixth Sense

In the words of Pranav Mistry, the inventor of the Sixth Sense Technology, "Sixth Sense is a wearable gestural interface that augments the physical world around us with digital information and lets us use natural hand gestures to interact with that information."[1]

In a world driven by computers, we are losing out on our connection with the physical world. Though we cannot eliminate the amazing potential of our virtual world, we must not isolate ourselves from what is real. This creates a need to bridge the gap between these two worlds so as to avoid complete isolation from or dependency on either of the two.

Fig .1: Sixth sense technology demonstration

Sixth Sense technology tries to combine the real and the digital world which today, exist as two separate but equally important entities. It uses simple devices such as mirrors, mouse, projectors etc., to achieve a versatile interface which communicates with the real world and projects it on to the digital world.. Daily jobs such as collating information from various newspapers, editing documents etc., can be performed without dependency on the conventional sources along with reduction in the use of time. Fig 1.shows the demonstration of sixth sense technology.

Humanoids

In 1495, Leonardo Da Vinci designed a humanoid automaton that looked like an armored knight. This was known as Leonardo's robot. [2] We can say that this was the first visualization made as to a robot resembling humans. Humanoids are robots which resemble the human body for the fact that they have a human like face, torso and limbs. They depend on the conventional senses like vision, hearing and touch to function. They are usually powered by battery, solar energy and electricity. A combination of these energy sources are relied upon for efficient functioning.

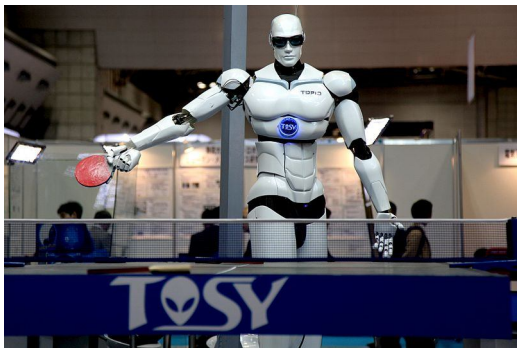

Fig.2: Humanoid robot [6]

George Charles Devol, Jr. was the first person to make use of digitally operated programmable robotic arm, Unimate. It was the first industrial robot which worked on the General Motors assembly line at New Jersey in 1961. In 1997, Hadaly-2 developed by Waseda University realized human interactive communication which was informational and physical. With each new development in this field, versatility and efficiency of the robots are increased tremendously. From physical movements to mental capabilities almost all aspects of a human are digitized. Fig 2. Shows a model of humanoid robot where in this case its used to play ping-pong..

Humanoids assist humans in various ways but only one important thing among several other reasons is a lacking in humanoids- i.e.the human-like movement which has the dexterity and speed that almost matches that of human which is the determining factor in many fields and numerous applications.

In this paper, this human-robot interaction shall be bought out using sixth sense technology(using sensors such as mouse rollers etc) and hence robots can be equipped with the movements that is directed directly by humans by the aid of a computer which acts as a medium between these two entities thereby achieving humanlike dexterity.

Combination of Humanoids and Sixth Sense

From times immemorial, humans have tried to substitute an object to complete the tasks assigned to them. From calculating numbers to analyzing a crime scene humans have automated every process. The working of a robot is very complex as it has to work with various variables simultaneously. The exact orientation, position, velocity etc., of the job assigned to it is unpredictable at least from the robot's point of view.

Human limbs have more than 25 degrees of freedom [3] and to reproduce the exact movement of human limbs to the extent of dexterity that humans possess is not easily possible as understanding the movements in itself is complicated and translating those to a mechanical device is near to impossible. Hence, robots with autonomous capabilities can function more effectively.

In this paper an attempt is made to produce human movements using the sixth-sense technology which takes into account the minute details of our limbs and is also cost effective and versatile compared to the already existent motion capturing systems.

HARDWARE REQUIREMENTS

The most basic requirement of the proposed hybrid-humanoid is a digitally automated humanoid which imitates the movements specified by a computer. The set of devices required to project actual human movement onto the digital world consists of the ones made use of by Pranav Mistry in his initial experiments viz., sensors, tracking device, camera, mirror, projector, microphone and a portable computing device.

FUSING THE TWO TECHNOLOGIES

The first and foremost task is to map human movement onto a digital interface. This is achieved by the Sixth Sense devices. In his initial experiment with mouse rollers, Pranav Mistry maps the movements of a human hand onto a computer. The movement of a mouse is determined by the computer using the XY axes on which its rollers move. Pranav Mistry took this aspect, and connected the rollers to his fingers and let the computer determine their movements in a similar way it determined the movements of a mouse.

This paper proposes taking the same concept to a higher level by taking the whole human body into picture rather than just the hand. To achieve this, sensors are placed on every joint of a human body. The movements of these sensors are reproduced on a computer. Vision sensors such as CCD cameras are used to get visual input. Tactile sensors which are reactive to touch are used where we need handling and precision. Actuators which are electro-mechanical motors are responsible for motion and control mechanisms of a humanoid. [4]

When the computer reproduces the movements of the sensors, the same needs to be reproduced by the humanoid. Since the humanoid is fully automatic and connected to the same mapping device as the sensors, achieving exact movements will not be impossible. The technology used to create animated movies where actors' movements are recorded and used as a guide to duplicate the same by hand drawn figures on a computer can be used to map the sensors' movements.

The computer then sends the movement data of the sensors to the humanoid. The humanoid receives exact movements from the computer as was passed on by the sensors thus eliminating any need to manipulate it on the computer. Although, manipulation if needed can be done. A general mapping sequence of movements from the human body to the humanoid is depicted in the image below.

The final outcome i.e. mapping of human body to robot usually takes place following any of these mapping strategies. They are joint to joint mapping, functional pose mapping and object-specific mapping[5]. Joint to joint mapping is the simplest one as we can map the movements of human joints onto computer very easily where every joint will come with sensors which track each and every move of the joint.

Functional pose mapping and object-specific mapping are two different strategies. But we use joint to joint mapping of human body so every joint shall be mapped effectively and more accurately. These movements from the mapping shall be reproduced on the computer. Later, the movements on the computer will be used to guide the humanoid robot in each and every movement as directed by the human who wears the sixth-sense prototype.
Fig.3 shows the step by step implementation and automation where first image on right shows the various sensors(mouse rollers or any other pointing device sensors) on the human body. The second image from right shows the tracking of points(sensors) on the computer while the third is the application of these movements onto a simulation provided on computer. On the left we have the humanoid robot which mimics the motion of the simulation from the computer. This shall be used in various applications.

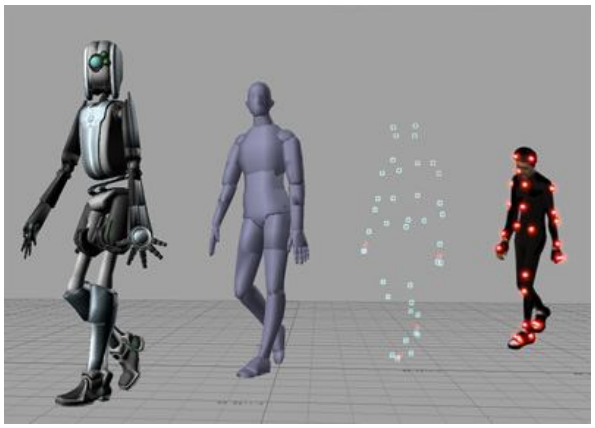

Fig 3: Stages of automation and implementation.

Hence we have a real-time translation of humanlike movements onto a humanoid robot which behaves the same way humans move and hence we have a fully controlled humanoid.

To increase the versatility of the hybrid-humanoid, it can come with the Sixth Sense prototype roughly as shown in the image shown in fig.4. This prototype will enable the humanoid to collect data from the surroundings and send it back to the human who is controlling it. This data will achieve the creation of a real time interface for the human mimicking the environment around the humanoid. By this, the humanoid robot can act as a real-time medium and humans can control the humanoid robot in a way he wants to get a desired task done and this feature of real time response shall be used in various applications.

The sixth sense apparatus on the humanoid robot will act as visual input device which serves as an interface between the activating human body and the humanoid robot. For practical applications, we may use another sixth sense device prototype on the humanoid robot itself to get a continuous visual input via the device so that we can track the environment the robot is in so that we can perform actions conducive and appropriate to that environment.

The sixth sense device on the humanoid robot will act as an input device as well as way to obtaining necessary feedback from the robot. This implementation is vital for applications where visual input is needed to drive the robot's action.

Hence we can categorize the hybrid-humanoid implementation into two phases namely

i. Real-time Analysis
ii. Motion translation

Real-time Analysis: In this phase, we will be tracking the surrounding environment of the robot using sixth sense device embedded with it. This will be done in real time so that we can track what the robot will be doing and at the same time describing the next course of action. This can be beneficial and useful in understanding the robot and its environment so that effective action of human body can be translated into motion by the robot using sixth sense device prototype.

Motion translation: In this phase, we will be sensing the movements of the human body using sensors placed at the joints of human body. These movements are captured using sixth sense device. Using computer as an interface between the human and the robot, the movements are translated into motion by the computer. Hence the motion will be translated to the robot.

By this, the sixth sense device can act as both as input device as well as a device that senses movements using sensors or color markers. For example, in situations such as in a volatile mine, we need to know where the robot is positioned and what its surrounding environment is. Based on

the visual input from the device embedded in robot, we shall be able to carry out the appropriate operations. Reliable and stable translation of motion can be achieved.

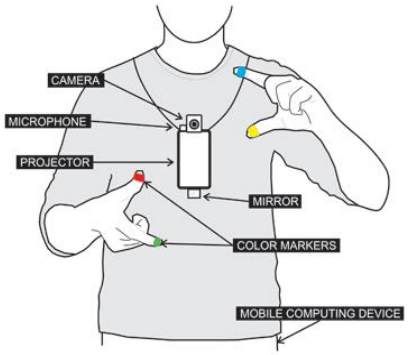

Fig 4: Basic hardware setup for sixth sense technology

CONCLUSION

Hence by fusing two technologies, 'Sixth sense' and robotics, we can achieve a humanoid robot which can mimic the movements of man and this will be useful in many ways. By this implementation, humanoids can behave in a more humanly manner and this can be applied in various fields such as industry, transportation, etc. This implementation can be used for rescue operations in volatile mines and hazardous surroundings which are deemed too dangerous for humans.

This can also be used in clearing debris, nuclear waste and other other dangerous disposal operations. An extension of this can also be used for space exploration.

Many applications can be found in gaming, animation and film making where humanoid robots can be used to mimic humanly Movements and action

REFERENCES

[1]. http://www.pranavmistry.com/projects/sixthsense
[2]. http://en.wikipedia.org/wiki/Leonardo%27s_robot
[3]. Bezdicek,Caldwell," Portable Absolute Position Tracking System For Human Hand Fingertips", Cancún, Mexico, 2006
[4]. http://en.wikipedia.org/wiki/Humanoid_robot
[5]. Minas V. Liarokapis, Panagiotis K. Artemiadis and Kostas J. Kyriakopoulos," Functional Anthropomorphism for Human to Robot Motion Mapping".