GESTURE CONTROLLED HOME AUTOMATION

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ABSTRACT

Gesture recognition is a growing area of interest because it provides a natural 3D interface for humans to communicate with computers. Hand gesture based electronic device control is gaining more importance nowadays. Most of electronic devices focus on the hand gesture recognition algorithm and the corresponding user interface. The gesture based wireless 3D accelerometer is a breakthrough technology. It takes the input as gestures by using an accelerometer and feeds into the computer. Various sensors capable of detecting motion in free space have been commercially available for several decades and have been used in automobiles, aircraft and ships. Initial size, power consumption and price, however, prevented their mass adoption in consumer electronics until the past few years. But, the advent of simple inertial navigation sensors like accelerometer can be utilized in getting Dynamic or Static acceleration profile of movement. The gesture based 3D accelerometer can be treated as the new age input device. It is more natural in its feel and provides the user with better ease of use. The user interface of applications can be changed to utilize the free hand movement possible with the device.

Keywords—accelerometers, automation, gesture recognition, new age device, sensors.

I. INTRODUCTION

Gesture is defined as a motion of limbs or any other body part which are made to emphasize speech. It can also be defined as an act or a remark made as a sign of attitude.Humans naturally use gesture to communicate. Using this process, human can interface with the machine without any mechanical devices. Human movements are typically analyzed by segmenting them into shorter and understandable format. The movements vary person to person. It can be used as a command to control different devices of daily activities, mobility etc.

A gesture is scientifically categorized into two distinctive categories: dynamic and static. A waving hand means goodbye is an example of dynamic gesture and the stop sign is an example of static gesture. It is necessary to explain all the static and dynamic gestures over a period of time in order to understand full message. Gesture recognition is interpretation of human motion by computing device. Hand gesture can be detected by controller that contains accelerometers to sense tilting and acceleration of movement.
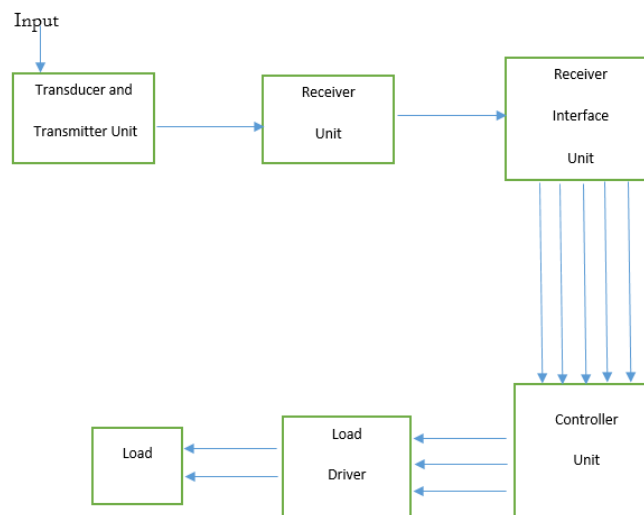
II. METHODOLOGY

Fig. 1 Functional Block Diagram of Gesture Controlled Home Automation

The inception of the idea comes primarily from the ongoing need for automation everywhere around. Automation has spread its web so rapidly and so efficiently that almost every sector is exploiting its advantages. It would not be an exaggeration to say that nowadays, automation is not only confined to the manufacturing industries but has seeped into every aspect of our daily living.

Home automation is building automation for the home. It involves control of lighting, heating, appliances, ventilation, AC, security etc. The devices can be controlled by creating a Personal Area Network and connecting them via an interface. Such devices can now be connected to the internet by interfacing with the router. This is called the Internet of Things. Another way of controlling the home appliances is by using hand gestures.

Gesture controlled switching of appliances is novel way of controlling devices. The user can switch the appliances just by the movement of his hands. The different movements can be mapped to control different appliances. The main purpose of the project is to develop a hand held device which when paired up with the receiver module interfaces the home appliances to the gestures of the hand. The capturing of hand gestures is done by using a three axis accelerometer. An accelerometer is a dynamic sensor capable of a vast range of sensing. Accelerometers are used mainly for the purpose of velocity measurement, as a sensor of orientation, tilt or direction in 2 or 3 directions and as shock or vibration sensor. Most accelerometers are Micro-Electro-Mechanical Sensors (MEMS). The basic principle of operation behind the MEMS accelerometer is the displacement of a small proof mass etched into the silicon surface of the integrated circuit and suspended by small beams. Consistent with Newton's second law of motion ($F = ma$), as an acceleration is applied to the device, a force develops which displaces the mass. Upon displacement of the mass, the accelerometer unit acts a transducer and gives an output in the form of voltage.

The voltage output of the accelerometer is then sent to the microcontroller, which processes it accordingly and is then sent to the encoder. The encoder is required for converting the data into serial form for transmission over a wireless network. The backbone of the gesture controlled home automation is the RF based wireless

communication. The data of accelerometer is sent to the receiver by the RF module. The receiver side will decode the data and will actuate the proper relays for switching the devices.

The plus points of the system are that it makes life easier and comfortable, it can be used to operate any device which is inaccessible, various applications in areas such as sign language, navigation system, medical research etc. These kind of systems can be definitely used for helping visually impaired personnel to interact with their surroundings and can prove to be a very promising and assuring technology in the future.

The main steps involved in capturing the gestures and using them to switch appliances are:

1. The tilt angle of the hand is captured by the 3 axis accelerometer ADXL335 in the particular direction (x, y or z).

2. The microcontroller Atmega 8A reads the data from the accelerometer and processes it.

3. Next, the data is sent to the HT12E encoder IC for parallel to serial transmission, making it suitable for transmission.

4. The accelerometer data is sent to the receiver over RF wireless link at 433 MHz.

5. At the receiver side, the decoder HT12D decodes the data and sends it to the microcontroller.

6. The microcontroller then actuates the relays which switch the appliances.

7. The motor is driven by the L293D Driver IC which changes the RPM of the motor with different tilt value from the accelerometer.

8. Hence, gesture control is achieved.

II. APPLICATIONS OF GESTURE CONTROL

No matter how powerful and complex, you always have to be near a machine and somehow in physical contact with it to interact with it. But gesture recognition technology could change all that. If perfected and used correctly, it could actually render traditions redundant. Some of the applications include:

2.1 Medical Applications

Advanced robotics systems with gesture recognition can be placed in hospitals or homes to recognize and treat life threatening conditions like heart attacks or strokes. A person in his home, if experiences a heart attack or other major attack his body movements and expressions will change. The tracking system including cameras with image processing can trigger an alarm based on sudden change of facial expressions or can compare with its own stored data. This can prove to be extremely valuable for saving lives by alerting others in the crucial seconds.

2.2 Alternative Computer Interfaces

Gesture recognition, along with voice recognition, facial recognition, lip movement recognition and eye tracking combined can be used to create something called a perceptual user interface (PUI), a completely different way to interact with computer systems which will improve usability and creativity by leaps and bounds. The use of gestures can also be found in the concept of augmented reality. Augmented reality involves overlaying the physical reality with virtual reality and these virtually overlaid objects can be controlled by using hand gestures captured by sophisticated sensors.

3.3. Entertainment Applications

Most videogames today are played either on game consoles, arcade units or PCs, and all require a combination of input devices. Gesture recognition can be used to truly immerse a players in the game world like never before.

Fig. 2 TV Control using hands

3.4. Safety Enhancement while Driving

One of the major breakthroughs of the gesture control will be reducing the distractions of the driver, which in turn will help to reduce the number of accidents on road. Driver distraction is a major cause of concern for maintaining safety on the road. Taking your hands off the steering wheel and eyes off the road to adjust air conditioning or making a call can have dire consequences. Gesture based car controlling systems would enable drivers to do all that and even more without even looking at the dashboard.

Automobile manufacturers are integrating gesture recognition features in their cars to let drivers manage the control systems of the car. For example, an approaching hand can activate the in-car infotainment system, or tilting your head can switch on the turning indicator.

It can also be used to detect drunkenness and drowsiness. An infrared camera is mounted on the steering wheels cars. The camera maps the human face to detect whether the driver is drowsing off to sleep or watching away from the road.In conjunction with a radar system, this technology will enable the car to deploy safety airbags quicker in case it detects an imminent collusion. It could also be made to apply brakes or alert the driver through speakers or vibration.

Fig. 3 Gesture Control in cars

3.4. An easier life for the disabled

One of the biggest challenges faced today is providing separate and equally non cumbersome services to the differently abled and handicapped. While there are special provisions around the world, there's still huge room for improvement to bring all lives on equal footing. Gesture recognition technology can eliminate a lot of manual labor and make life much easier for those who aren't as fortunate as most of us are. As an example, if a blind person has gesture recognition system installed at his home, he would not require to go to the switch board to switch on the lights. He can just turn them on with a swipe of his hands.

Another add- on to this can integrating this with the Internet of Things (IoT). Using IoT all the devices in this person's house can share data can be switched on or off using gestures. It would make the life of these simpler and reduce the hardships they face in their daily lives.

IV.CONCLUSION

Gesture Control Home Automation can have myriad applications. The prime objective to focus on in the near future should be how to enhance these technologies and make their implementation easier so that every person can use them easily.

Gesture based technologies have the potential to be the game- changer in how we interact with the machines around us. With the advent of Artificial Intelligence (AI), capturing gestures and using them is becoming easier. The machines around us are becoming much more aware.

From the economic point of view, the gesture based control systems are at a disadvantage. This is because the methods and equipment required for capturing high profile gestures like reading facial expressions, or triggering a process using a particular gesture require highly sophisticated devices and algorithms. Incorporating them into mass produced cheaply available, ready-to-install devices will be an uphill task. There is need to devise simpler methods to capture movements and also provide a wide range of operations and device compatibility.

All in all, gesture based automation techniques are proving to be a boon for developing futuristic application interfaces. They have an application in every field one can imagine, be it home automation or medical field or any other, these technologies are drawing the boundaries of human- machine interaction closer. Efforts are underway in all of the areas identified in this report to strengthen the empirical understanding of the impacts of specific initiatives. It is desirable that these efforts be supported in order for the gesture controlled systems to be rolled out in an effective manner and deliver all of the potential benefits that they could provide to the humanity.

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