GESTURE CONTROLLED HOME APPLIANCES

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Abstract: **This paper presents an alternative and enhanced approach to control home appliances with hand gestures. Here we are developing automation prototype module for the household. In this paper we mostly concentrated on the interfacing of the gesture to the basic hardware. The main hardware equipment .For the functionality of the module are accelerometer, microcontroller and respective sensors .this module will increase the flexibility with simple human machine interface. In addition to this, module can also help the physically challenged for easy remote access and control of the appliances.**

IndexTerms **– Home Appliances, Sensors, Automation.**

I. INTRODUCTION

Home automation is a system in which actuation and the control are decoupled by a firmware layer. The foundation for the home automation systems was laid in the early 1990's, which has been upgraded to the much more complex and sophisticated level which evolved the human habitat. During the early days of automation we used to use the interfacing classical electrical circuit which mostly had buttons and switches but had no integrated systems[1].

As of today the interfaces have remained the same but the technology has been upgraded to touch panel's i.e., wired and wireless where as the integrated systems became the heart of the technology and usage of audio or video data, thermal imaging and control, adhoc interconnection has been implemented in the commercial domain exponentially as the days pass by. In the near future the basic challenge of the home automation domain will be mostly concentrated for potentially developing automation integrating system for the classical electrical interface systems like buttons and switches[2]. There comes the scope for the gesture as it can be considered as the minimum effort to be provided to actuate a signal and make the appliance run. This type of systems will provide the secured access to home appliances and can also be implemented with the IR sensors, kinect sensors, vision systems, GPS modules, mobile phones, proximity sensors, bimetallic strips.

In gesture we can have a flexible and multiple amounts of possibilities for controlling a particular system and getting different outputs. Gesture can be effectively implemented using the vision and other communications systems as there are significant losses in the traditional 3 phase wiring due to eddy losses, breakage losses , thermal loss, losses due to back EMF[3] . Where as in the communication systems the efficiency is much higher ~0.9. Even though the communication systems are highly effective, some of the performance is squeezed by the losses such as noises like –thermal noise, transmission losses, interference, propagation losses by which the intensities of the wave guides may get reduced[4].

Optical fibers can also be used for effective communication and interfacing between the various home appliances and this mostly helps during the simultaneous actuation. this leads to smart systems like temperature control based on the external environmental temperature and maintaining a proper amount of humidity values to the air circulated as of in air conditioning systems, brightness of the room lighting control based on the external factors like day and night, cloudy or sunny etc. by all these features the advanced home automation makes the life in abode much more ambient[5],[6].

The system inputs are taken from the hand gesture glove sensor employed with a 3-axis accelerometer. The following are the steps describing the glove sensor

A-inputs for the gesture sensor: the inputs are taken by positioning of the accelerometer
B-data transmission- transmits all the data received from the senor to micro controller
C-gesture processing –converts the raw gesture input to process-able input
D- Transmission of data to the required appliances

II. COMPONENTS USED

The FIG 1 depicts the system architecture and components required for the module.

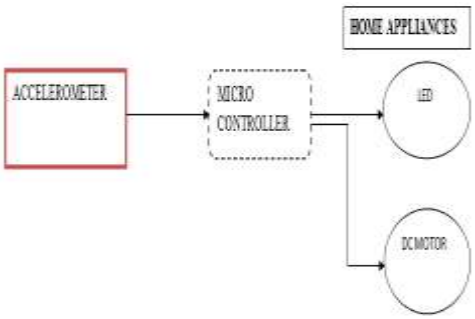

FIG 1:SYSTEM ARCHITECTURE

2.1ACCELEROMETER

The accelerometer ADXL3XX is a transducer as shown in Fig 2 which converts the mechanical motion to the electrical signals .The working of the accelerometer is by measuring the acceleration or tilting in particular direction. The principle behind the accelerometer is the mass exerted on body when a force is applied. it is used in measuring and sensing the G-force which is also known as proper acceleration and it is entirely different from the concept of coordinate acceleration.

It is actually used for sensing the gradients in the proper acceleration reference frames and these instruments are known as gravity gradiometers and theoretically these are much more useful and able to detect the gravitational waves. There are generally 3 types of accelerometers available commercially they are piezo electric, piezoresistive, piezo capacitive. The piezo electric accelerometers are mostly composed of lead zirconate titanate and quartz, tourmaline crystals to achieve the higher sensitivities we can use the concept of quantum tunneling. Mostly these accelerometers are designed using the concept of micro electro mechanical systems (MEMS).

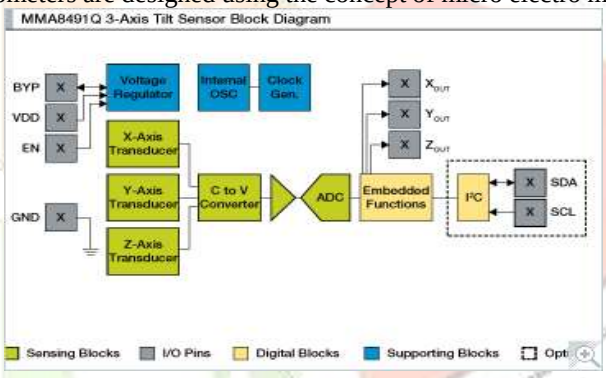

FIG 2: ACCELEROMETER BLOCK DIAGRAM

2.2 MICROCONTROLLER

Microcontroller is a small computer on an integrated circuit having a processor core, memory unit and I/O peripherals. Here the microcontroller used is ATMega328a (Pin out diagram of the IC is shown in fig 3 and fig 4), which is a Reduced Instruction Set Computer based microcontroller which has 32 Kb of flash memory with Read-while-Write capabilities.

It has an operating range of 1.8 to 5.5 V. The device has good throughput. The program is burned to the microcontroller using Arduino Microcontroller kit. Freeduino is used to program ATMega328a.

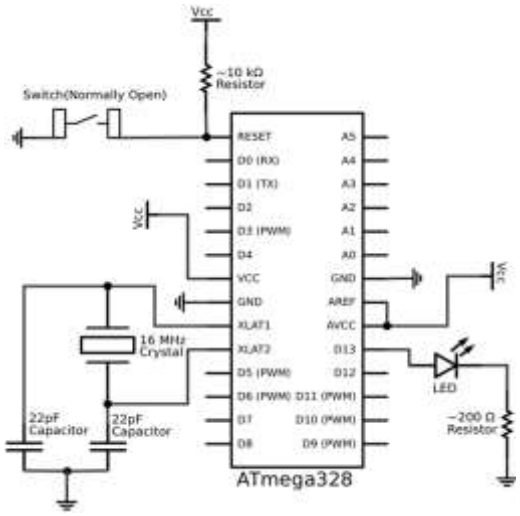

FIG 3: PIN DIAGRAM OF ATMEGA328A

FIG 4: ARDUINO MICRO CONTROLLER

2.3 DC MOTOR

Direct current motor is another widely used device that translates electric pulses into mechanical movement. The direction of the DC motor is controlled by giving voltage source to the positive and negative terminals and can also be reversed for the opposite direction.

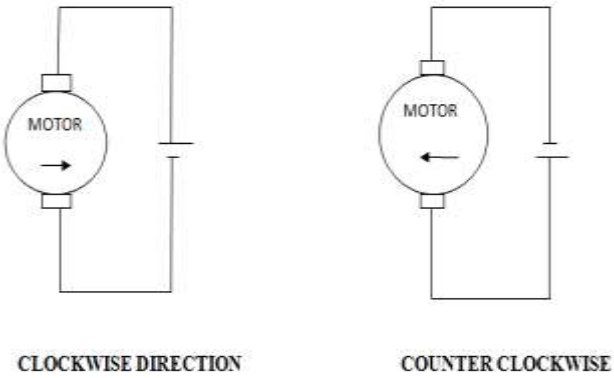

FIG 4: BI-DIRECTIONAL DC MOTOR

As we are interfacing gesture with the DC motor we can control the DC motor direction using the gesture movements.

III. GESTURE CONTROL

This system achieves man machine interface using various gesture movements to control complex electronic system via usage of mathematical algorithms. Gesture control can be generally grouped into two types i.e., offline and online. In offline systems the processing of the data is done after the human contact where as in online systems there is a direct interaction with the object used to manipulate the orientation in the spatial coordinates. The various technologies available in the commercial fields are wired gloves stereo vision cameras etc.

In vision based gesture control systems image noise creates a significant hindrance in achieving the proper and accurate gestures in space time.

IV. FUNCTIONALITY OF THE SYSTEM

The functionality of the above mentioned system starts with the accelerometer. The accelerometer is interfaced with the microcontroller through a six pin wires. This interfacing can be achieved by using various software available here we are using C language and freediuno compiler through which a meaningful data transfer and proper control over the system can be attained. The accelerometer works with 3 axes in which X, Y, Z are measured and transmitted to the microcontroller the microcontroller reads the accelerometer readings by taking the angle of the axis mentioned for specific operation.

The microcontroller reads the value in analog form and transmits it to the peripherals as a digital value because the digital values are measured from (0-5) v it will be easy to drive the specified peripheral or to actuate the corresponding sensor. In this system we are fixing the boundary values in the rotation angles with respect to X and Y coordinate axis. Here we are assuming two variables (fb and lr) to represent the angles of world coordinate frames with respect to the standard local glove coordinate frame. Here variable fb is assigned to the values of the angles occurring between the Y-axes of the two coordinate frames(global and local).similarly variable lr is assigned to the values of the angles occurring between the X-axes of the two coordinate frames(global and local). In this setup the difference angle values both in X and Y axis is set to be 330 degrees and 350 degrees. These values can e chosen arbitrarily based on the human comfort and can also be changed in the machine code if required.

V. CONCLUSION

This paper has made an attempt to solve the various complications and reduce the effort in accessing and proper control of home appliances using the gesture control. By the construction of the basic model of this hardware we can easily observe the user friendly and enhanced nature of the approach used.

VI. ACKNOWLEDGMENT

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