

# MEMS ACCELEROMETER FOR DOMESTIC APPLIANCES

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## I. INTRODUCTION

**Abstract**—This project has been developed to design a system that facilitates a user to securely control multiple home appliances using hand gestures. The project uses MEMS accelerometer sensor to read hand gestures and provides an analog input signal to Arduino Uno micro-controller. The hand gesture movement thus recorded controls the circuit to turn it on or off. The micro-controller processes the input data from the sensor and makes use of a Relay driver to control the on/off operation of the home appliances. The system communicates with the appliances using RF technology within the range of 3Hz to 300GHz. MEMS technology mainly deals with the devices which involve motion of the object. Accelerometer detects the motion in three directions (x, y,z). Accelerometer is an electromechanical device that measures the force of acceleration due to gravity. This project helps many disabled, visualized, challenged and semi-paralyzed persons to control the appliances from far distances. Gesture recognition is technology that uses sensors to read and interpret hand movements as commands. Traditional home automation systems are not cost effective and they are not suitable for aging populations and disabled persons.

**Keywords**—Accelerometer, Arduino UNO, Wi-Fi communication, Sensors.

AMicroelectromechanical Systems (MEMS) is the technology of small devices that in general form to be defined as miniaturized mechanical and Electro-mechanical elements that are made using the techniques of micro fabrication. MEMS are made up of components between 1 to 100 micrometers (20 millionths of a meter) to a millimeter (I.e. 0.02 to 1.0 mm).Micro Electro mechanical systems (MEMS) refer to a collection of micro sensors and actuator that can sense its environment through measuring mechanical ,thermal ,biological, chemical, optical, and magnetic phenomena. The electronics then process the information derived from the sensors and through the decision making capability direct the actuators to respond by moving, positioning, regulating, Pumping and filtering thereby controlling the environment for some desired outcome or purpose.

The system may also need micro power supply, micro relay, and micro-signal processing units. Micro components make the system faster, more reliable, cheaper and capable of incorporating more complex functions.MEMS are not about any one application or device, nor are they defined by a single fabrication approach that conveys the advantages of miniaturization, multiple components, and microelectronics to the design and construction of integrated electromechanical systems; they are also a new paradigm for designing mechanical device and systems. Embedded systems are a system which performs a specific or a pre-defined task. It is the combination of hardware and software. It is nothing but a computer inside a product. It is a programmable hardware

design nothing but an electronic chip. A general-purpose definition of embedded systems is that they are devices used to control, monitor or assist the operation of equipment, machinery or plant. "Embedded" reflects the fact that they are an integral part of the system.

In many cases their embedded may be such that their presence is far from obvious to the casual observer and even the equipment for some time before being able to conclude that an embedded control system was involved in its functioning. At the other extreme a general-purpose computer may be used to control the operation of a large complex processing plant, and its presence will be obvious. All embedded systems are or include computers or microprocessors. Some of these computers are however very simple systems as compared with a personal computer.

## II. RELATEDWORK

The fundamental point of this work presents an alternative and enhanced approach to control home appliances with hand gestures. Here we are developing an automation prototype module for the household purpose. This project can also help the disabled people for easy remote access and control of the appliances.

## III. METHODOLOGY

Oursystem's suggested approachistomakeapersonasautonomous as possible to assist them adjust to life withparalysis. We see a difficulty with the size and cost of theequipment that are being built for this kind of technology.They seem to be restricted to hospital usage and not used atthepatient'shomeorattheirconvenience.

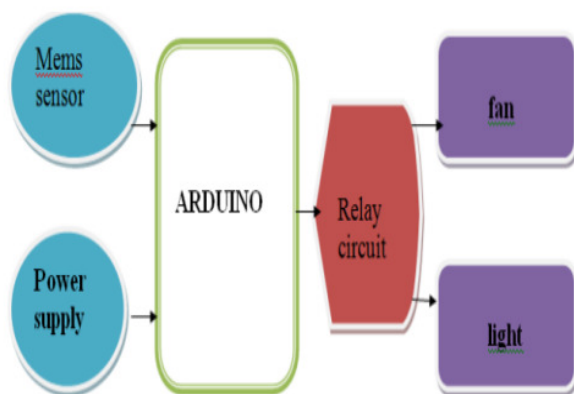


Figure1:BlockDiagram

### A. Arduino Uno Board

Oneofthemostpopularmicrocontrollersinusetodayisthe Arduino UNO. It is really handy, simple to handle, andutilize.Thismicrocontroller'scodingisfairlystraightforward. Duetoflashmemorytechnology,thismicrocontroller's programmer is regarded as unstable. Thismicrocontrollerhasabroadvarietyofuses,includingindustria lautomation,remotesensing,householdappliances,andsecurity. Thismicrocontrollerhasthecapacity to connect to the internet and function both as aclientandaserver.

### B. 16x2 LCDDISPLAY

An electronic display module called an LCD (LiquidCrystalDisplay)screenhas severaluses.A 16x2LCDdisplay is a very fundamental module that is often includedintomanydifferentdevicesandcircuits.Thesemodulesare preferable over multi-segment LEDs with seven segmentsand additional segments. The explanations are that LCDs areinexpensive,readilyprogrammable,andhavenorestrictionsfor displaying unique and even bespoke characters, animations,andotherfeatures.

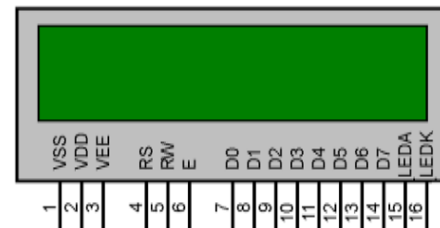


Figure2:LCDDisplay

### C. MEMS,ormicroelectro-mechanicalSystem

Micro Electro-Mechanical System, or MEMS, is a chip-basedtechnology thatusescapacitive sensorsmade of asuspended mass between two plates. This hanging materialcauses an electrical potential difference when the sensor istilted. A change in capacitance is then used to measure thedifference thatwasgenerated.

"FAN ON"

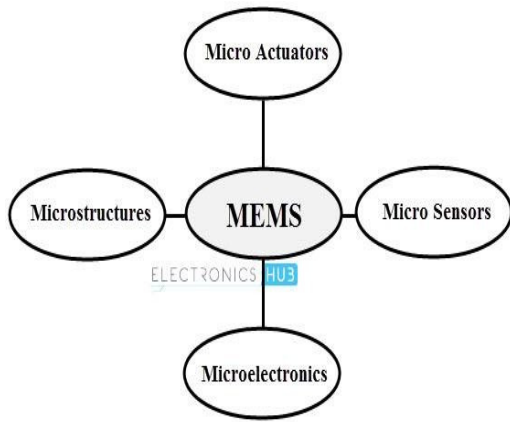


Figure3:MEMSAccelerometer

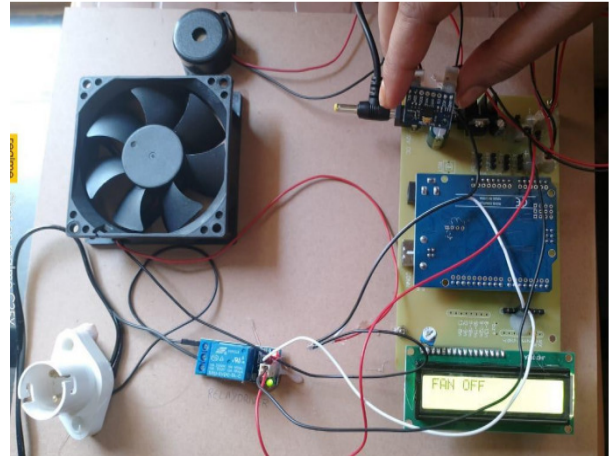


Figure6:When MEMS is tilted South side direction, based on the gesture "FAN OFF"

#### IV. EVALUATION DATASETS AND RESULTS

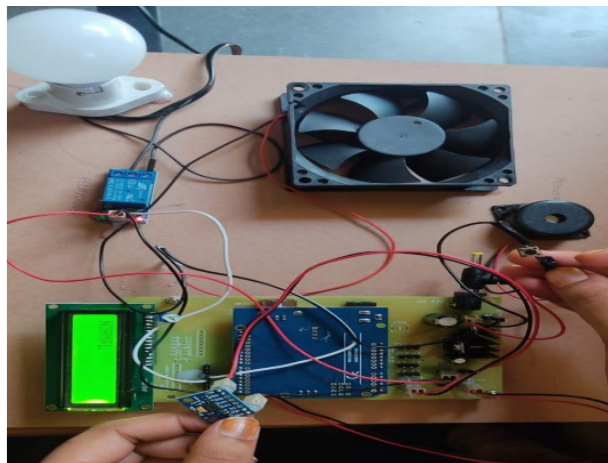


Figure4:Experimental Setup when load devices are in normal condition

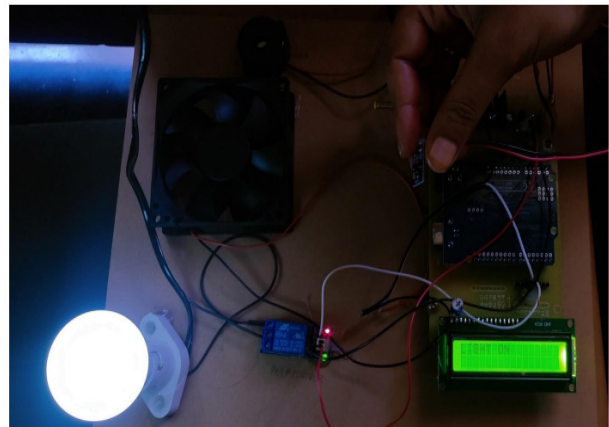


Figure7:When MEMS is tilted East side direction, based on the gesture "LIGHT ON"

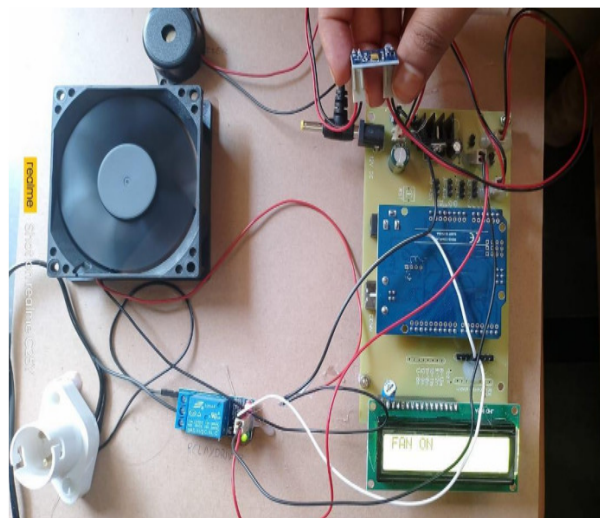


Figure5:When MEMS is tilted North side direction, based on the gesture

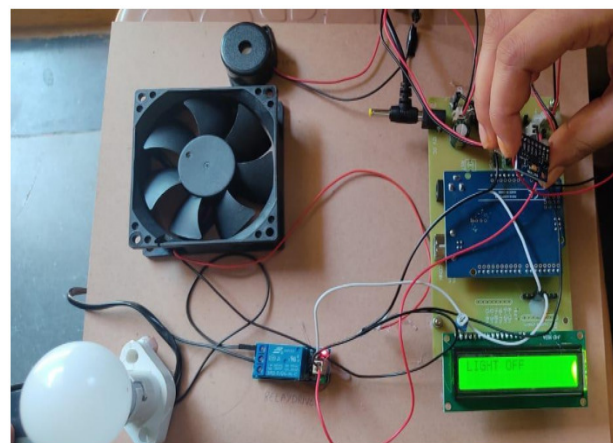


Figure 8: When MEMS is tilted West side direction, based on the gesture "LIGHT OFF"

**CONCLUSION**

The project has been developed with ease of use and accessibility in mind. The gesture controlled system provides an easy mechanism for people, especially people with special challenges, illness, old age etc. Using MEMS technology, the system is gesture controlled.

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HAND MOVEMENT OR DIRECTION	LOADOPERATION
UP	LOAD 1 ON (FAN ON)
DOWN	LOAD 1 OFF (FAN OFF)
RIGHT	LOAD 2 ON (LIGHT ON)
LEFT	LOAD 3 OFF (LIGHT OFF)

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