MEMS BASED HOME APPLIANCE CONTROL

MD.Nayeemuddin, D. VijayaSaradi, P. Sri Padma Priya, V. Sri Harsha, P. Rehaman khan, V. Abhilash

Abstract: This paper has been developed to design a system that facilitates a user to securely control multiple home appliances using hand gesture. The paper uses the MEMS technology to read hand gesture and provides an analog input signal to the ATmega328P microcontroller. The hand gesture movement thus recorded controls the circuit to turn it on or off. The microcontroller processes the input data from the sensor and makes use of a Relay driver to control the on/off operation of the home appliances. Energy consumption can be reduced by20- 30% with this technology thus optimizing the power consumption in a home automation system. Furthermore, the system is secured with a gesture based password, through MEMS, to ensure security and protection from unauthorized usage.

Keywords: ATmega328P microcontroller, MEMS (Micro Electro Mechanical Systems), Relay, LCD, Display.

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Introduction:Usage of technology has increased manifold in recent times to enhance our experience and make our life easier. Home automation system is one such scenario where this phenomenon can be easily seen. A large no of electrical appliances are used in home to help us with various work. Most of these appliances work independently on their own. But the recent trend in making these appliances smart and connected to each other has further made it easier operating them. With the home environment becoming more automated, there is a need for better and efficient system of controlling it. This paper proposes a home automation system which is gesture controlled and password protected for a secure home environment. The paper is based on MEMS (micro electro mechanical system), which is used to control the home appliances using hand gesture. When a user moves the device, the mechanical movement is recorded and converted to electrical signal in X, Y and Z coordinates. This signal is then sent to the microcontroller. In this paper microcontroller ATmega16 act as a master and the MEMS act as a slave. The command is given by the MEMS is displayed in the LCD. This paper is uses the +5v, 500mA power supply. Here bridge rectifier is used to rectify the AC supply of secondary of 230v/12v step down transformer. Capacitor is used as the filtering circuit. 12v unregulated voltage is used for the relay. For the voltage regulation 7805 three terminal voltage regulator is used.There are various methods to control the home automation system which is related to IP based home automation system which is controlled by the IP network.

Proposed Scheme: The proposed system is aimed at designing a cost effective control of home appliances through Hand Gestures. In this paper the appliances are controlled using MEMS. This system consist accelerometer which is used to measure the hand gesture, microcontroller, RF technology for transmitting and receiving the signals following through the system. The whole system is the password protected for the secure home which is stored in the microcontroller Atmega16.
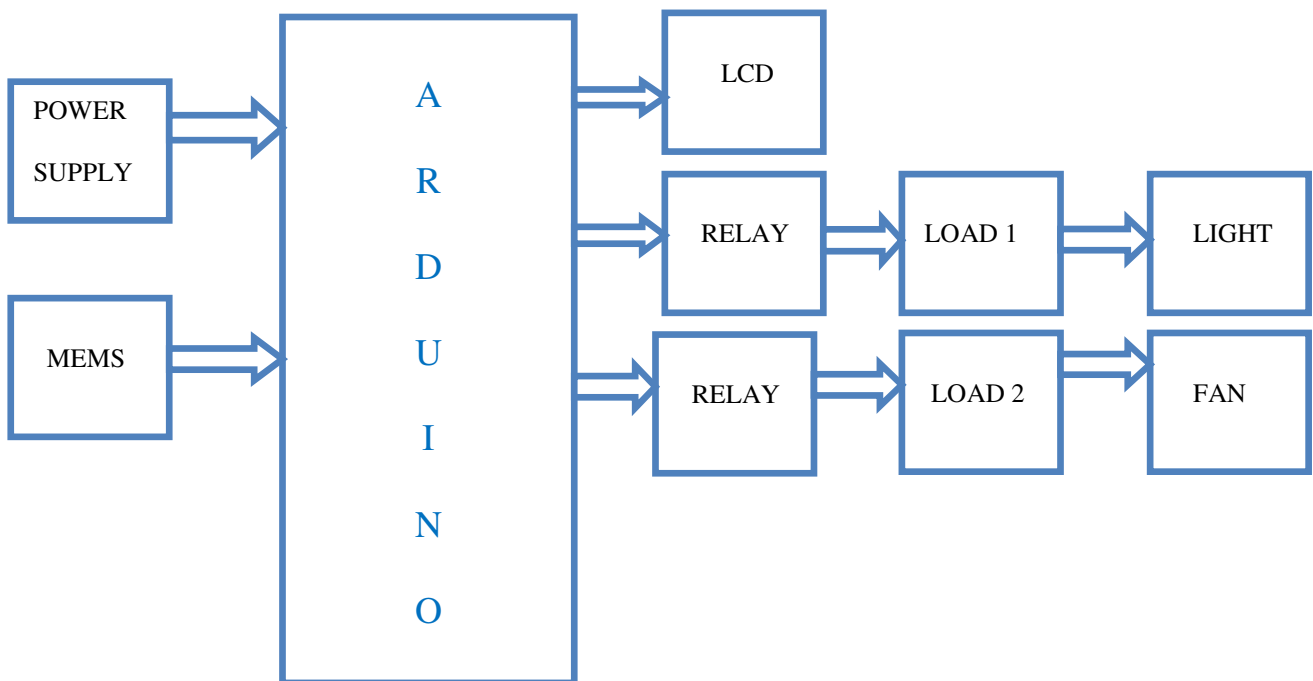
HARDWARE DESCRIPTION

Figure 1: Block Diagram of MEMS Based Home Appliance Control

Figure1. Shows the block diagram of MEMS based home appliance control. It consist a various component. MEMS accelerometer is used for sensing the hand gesture movement of the person. Atmega328P microcontroller is used as the master component of the system which is used to control the whole system .the movement of the hand is already store in the microcontroller. All the status of the appliances is displayed in the LCD.

MEMS (Micro electro mechanical systems)

Micro electro mechanical systems (MEMS) (also written as micro-electro-mechanical, MicroElectroMechanical or microelectronic and micro electro mechanical system) is the technology of very small mechanical devices driven by electricity and it merges at the Nano scale into nanoelectromechanical systems (NEMS) and nanotechnology. It is a mechanical device driven by electricity. It converts mechanical hand movements into equivalent electric signals. Among many of the MEMS devices 3-Axis accelerometer is one.

ACCELEROMETER-ADXL203E:

An accelerometer is a device that measures the vibration, or acceleration of motion of a structure. It is an electromechanical device that will measure acceleration forces. These forces may be static, like the constantforce of gravity pulling at your feet, or they could be Dynamic - caused by moving or vibrating the accelerometer.
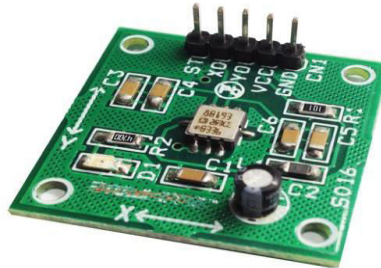

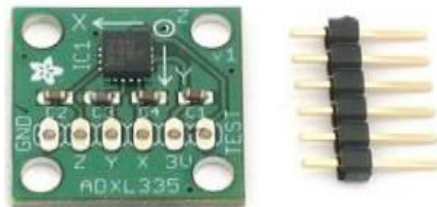**Figure 2: ACCELEROMETER- ADXL203E**

Figure 3: ACCELEROMETER-ADXL335

ATmega328PMICROCONTROLLER:

ATMEGA 328P is high performance, low power controller from Microchip. ATMEGA 328P is an 8-bit microcontroller based on AVR RISC architecture. It is the most popular of all AVR controllers as it is used in ARDUINO boards.

The high-performance Microchip piccoPower 8-bit AVR RISC-based microcontroller combines 32KB ISP flash memory with read-while-write capabilities, 1024B EEPROM, 2KB SRAM, 23 general purpose I/O lines, 32 general purpose working registers, three flexible timer/counters with compare modes, internal and external interrupts, serial programmable USART, a byte-oriented 2-wire serial interface, SPI serial port, a 6-channel 10-bit A/D converter (8-channels in TQFP and QFN/MLF packages), programmable watchdog timer with internal oscillator, and five software selectable power saving modes. The device operates between 1.8-5.5 volts.
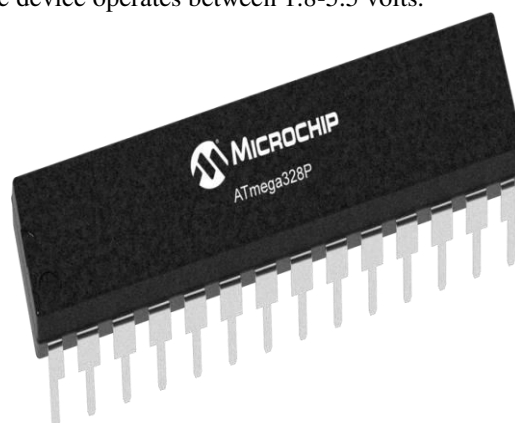

Figure 4: ATmega 328P Controller

RELAY

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A relay is an electrically operated switch. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. Relays are used for switching purpose of the home appliances.

Figure 5 : Relay

LIQUID CRYSTAL DISPLAY:
LCD is an electronic display module.**16x2 LCD display** is used for is system.**16x2 LCD** means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data.

Figure 6 : 16x2 LCD display

PIN	SYMBOL	FUNCTION
1	Vss	Power Supply(GND)
2	Vdd	Power Supply(+5V)
3	Vo	Contrast Adjust
4	RS	Instruction/Data Register Select
5	R/W	Data Bus Line
6	E	Enable Signal
7-14	DB0-DB7	Data Bus Line
15	A	Power Supply for LED B/L(+)
16	K	Power Supply for LED B/L(-)

Table 1:Pin Descriptio

POWER SUPPLY UNITS

A power supply is an electronic device that can use to supply the electric energy to the load.
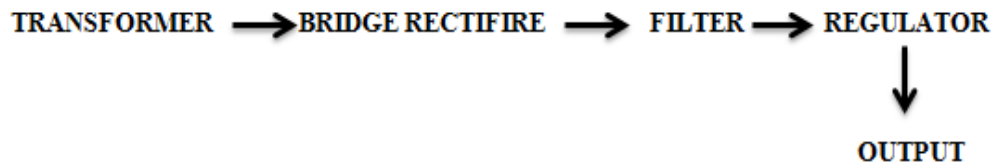
Power supply block diagram:

TRANSFORMER ⟶ BRIDGE RECTIFIRE ⟶ FILTER ⟶ REGULATOR
⟶ OUTPUT

Figure 7: Power Supply Block Diagram

This paper uses regulated +5V, 500mA power supply.Unregulated 12V DC is used for relay.

Implementation Results: The system is composed of two main parts:- (1) transmitter (2) receiver.Measures the vibration or acceleration of motion of structure that works on hand gesture.Accelerometer can move in major direction-right, left, down and up.

HAND MOVEMENT GESTURE (Direction)	LOAD OPERATION
Right	Load 1 OFF
Left	Load 1 ON
Down	Load 2ON
Up	Load 2 OFF

Table 2: Functions of accelerometer

If the direction of hand movement is completely towards right, then the entire four loads will turn on.And if the direction of hand movement is completely towards left then all the four loads will turn off.Usually, accelerometer works in 3-axis X,Y and Z but my system works in 2-axis X and Y.

In this Paper, we have MEMS, LCD, Light, Fan.

➢ First give the power supply.
➢ The data will be displayed on the LCD.
➢ Put the MEMS in stable condition.
➢ The data i.e., Load-1 & 2 OFF will be displaced on the LCD.
➢ When the MEMS faces left side Load-1 is ON.
➢ Load-1 ON is displayed on LCD.
➢ When the MEMS faces Right side Load-1 is OFF.
➢ Load-1 OFF is displayed on LCD.
➢ When the MEMS faces front direction the Load-2 i.e., fan is in ON Condition.
➢ The data Load-2 ON is displayed on LCD.
➢ When the MEMS faces opposite direction load-2 will be OFF.
➢ The data Load-2 OFF displays on LCD.
➢ After the completion of the process press the reset button.
➢ The reset button will reset the system.
➢ The process will be done.

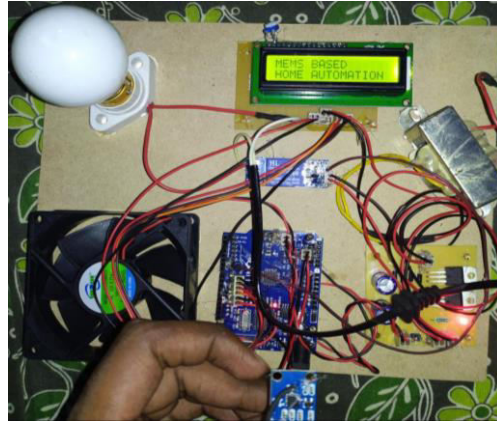# MEMS BASED HOME APPLIANCE CONTROL

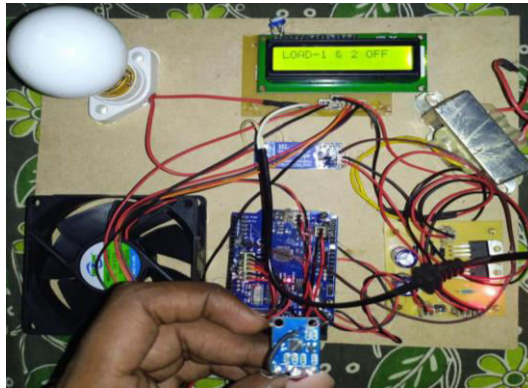**Figure.8:Data displayed on the LCD**
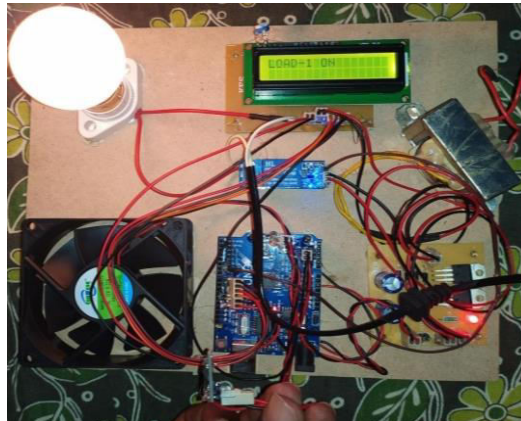

FIGURE 9: STABLE CONDITION OF MEMS
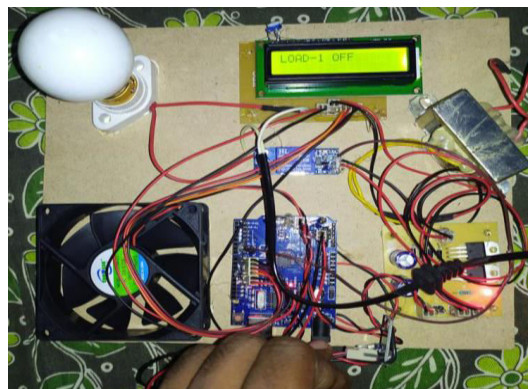

FIGURE.10:MEMS TURN TOWARDS LEFT
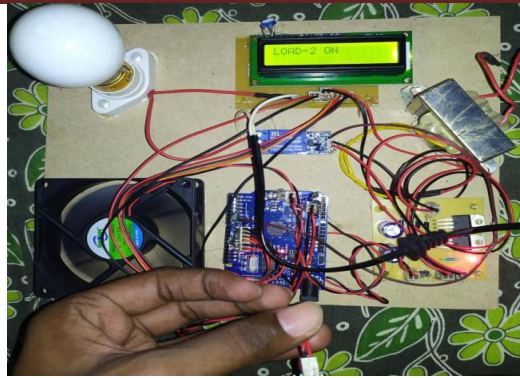

Figure.11:MEMS turn towards Right
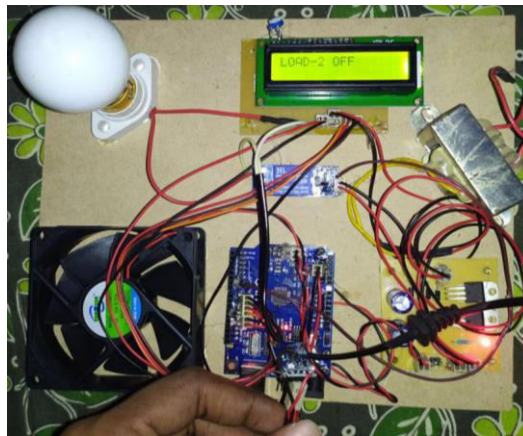
FIGURE.12: MEMS TURN TOWARDS FRONT SIDE

FIGURE.13: MEMS TURN TOWARDS BACK SIDE

Conclusion: The paper 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 and password protected. The password protection ensures secure use of the technology. The password itself is gesture based for easy access. Using the device, home appliances in the range can be controlled easily and securely.

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