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SOUND LOCALIZING CAMERA

Sumna Khan, Simrat Singh Gill, Sanyam Saxena,
Shivani Rajput, Shubham Kumar
Electronics & Communication Engineering Department,
Moradabad Institute of Technology, Moradabad, India

ABSTRACT

The camera platform designed in this project can turn its direction to face wherever a nearby hand-clapping or other similar sharp impulse comes from. If a person claps hands for more than once in the same direction in reference with the mobile phone or camera, this platform will instruct the camera to take a picture for each claps detected. If the person moves to a different location and claps his hands, the camera platform will adjust its direction accordingly. The system can distinguish between hand claps and most surrounding background noise such as normal talking. When we travel alone, it can be inconvenient to take pictures with yourself in it. Often, we have to hold the camera with our hands and capture a close photo with barely background. In a better case, we still need to pre-set a short timer, which requires us rushes back from the camera. Therefore, we came up with platform that uses microphones to detect clap direction and microcontroller with DC motor to control the camera.

KEYWORDS: *Microphones, Clap switch, Microcontroller, LCD Display, DC Geared Motor*

I. INTRODUCTION

Sound Source Localization (SSL) is the process of determining the spatial location of a sound source based on multiple observations of the emitted sound signal [1].The Sound Localizing Camera is a model which is used to take the photos. In this project the photos are captured as a stimulus to sound though hand clapping. The direction of the clapping source can be calculated based on the time delays between microphones, which is comparably long enough for the microcontroller to direct and measure the difference accurately .Three microphones are placed at three vertices of a equilateral triangular among which the first two microphones that detects the impulse are used to calculate the direction from which the clapping generated from. Then, the calculated angle is compared with the current direction of the platform. In this project three microphones are built into the analog circuit. The signals are amplified, high passed, low passed, amplified again and finally converted to digital signals and directly connected to the external interrupts of the microcontroller. The three interrupt service routines are programmed for three external interrupts from the microphones. The first ISR executed zeros the timer2 and stores its corresponding microphone number. When the second one comes in, it captures the timer2 as the time delay, stores its number and set a flag to be high to indicate that it is ready to calculate the angle. The third ISR is ignored since the stored time delays and two microphones numbers are the only data needed for the calculation.Algorithms for sound source localization can be broadly divided into indirect and direct approaches [2]. Indirect approaches usually follow a two-step procedure: they first estimate the *Time Difference Of Arrival* (TDOA) [3] between microphone pairs and, afterwards, they estimate the source position based on the geometry of the array and the estimated delays. On the other hand, direct approaches perform TDOA estimation and source localization in one single step by scanning a set of candidate source locations and selecting the most likely position as an estimate of the source location. The *Steered Response Power – Phase Transform* (SRPPHAT) algorithm is a direct approach that has been shown to be very robust under difficult acoustic conditions [4]–[6].

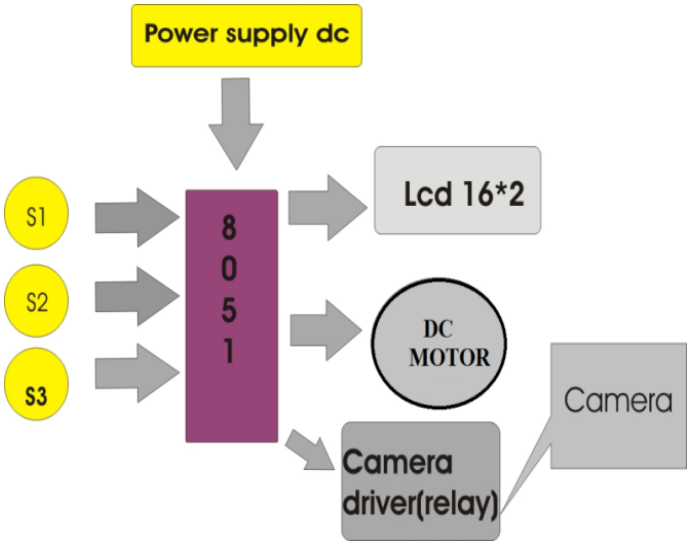

Fig1: Block Diagram

Figure1 Illustrates the basic block diagram of the working model of sound localizing camera

II. WORKING OF SOUND LOCALIZING CAMERA

The sound localizing camera model consists of three sensors which are used to detect the sound of hand clapping. The 12V power supply is used to stimulate the model, out of which 5V is passed to the microcontroller. To detect the sound of hand clapping three clap switch circuits are used as clutches to detect the position from where the higher sound comes from. The request is detected on the three ports of microcontroller P1, P2, and P3. When no request is detected by the microcontroller then it is at 5V and it set at logic 1. When the request is been detected by the microcontroller then it is grounded and is set at logic 0. The input and the output of the microcontroller are assumed to be zero. The output of the microcontroller is fed to the LCD 16*2 which is used to display the position that which number position sensor is on. The DC motor output is then divided by 120^0 so that the complete rotation of 360^0 can be covered by the three sensors. When the motor rotates, the camera is off and when the motor stops after rotation the photo is clicked. After clicking the picture the relay is used here to provide the switching mechanism. The delay has been provided by the microcontroller. In this way the whole process of the model takes place.

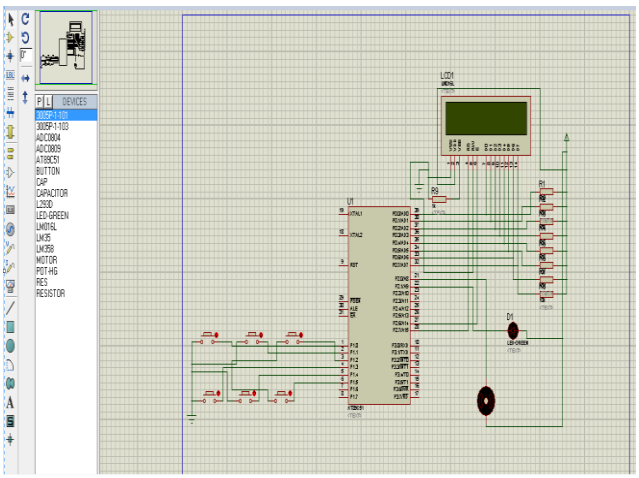

Fig2: Proteus Simulation

Figure2 Illustrates the simulation result of the sound localization camera performed on the proteus.

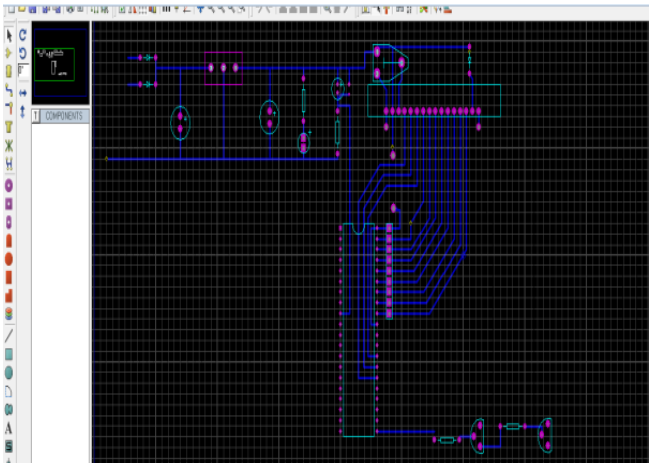

Fig3: PCB Layout

Figure3 Illustrates the PCB layout of the circuit diagram.

III. MICROPHONE USED

A microphone colloquially mic or mike, is an acoustic-to-electric transducer or sensor that converts sound into an electrical signal. The microphones are widely used in voice communications, hearing aids, noise, and vibration control [7]. Electromagnetic transducers facilitate the conversion of acoustic signals into electrical signal. In this project, we used condenser microphone. The sound of our claps is picked up using a condenser microphone.

Fig4: Condenser Microphone

Figure4 Illustrates the three microphones (condenser microphones) are electric transducer or sensor that converts sound into an electrical signal.

A condenser microphone is a microphone that uses a capacitor to convert the compression and rarefaction of sound waves into electrical energy. Condenser Microphones generally consist of a diaphragm that is vibrated by impinging waves of acoustic pressure, a back plate and air gap. In its simplest form, a diaphragm is placed over a conducting back plate and supported by copper wire so that a gap between the membrane and the back plate is formed [8]. Condenser microphones require power (voltage) in order to operate. This voltage is known throughout the recording industry as "phantom power". Because condenser microphones require power, they are generally much more sensitive than dynamic microphones. In addition, they usually have a much broader frequency response, faster transient response, and a hotter output than dynamic microphones.

IV. DC GEARED MOTOR

The DC motor works over a fair range of voltage. The higher the input voltage more is the RPM(rotations per minute) of the motor. The working of the gears can be explained by the principle of conservation of angular momentum [11]-[12]. The gear having smaller radius will cover more RPM than the one with larger radius. However, the larger gear will give more torque to the smaller gear than vice versa. The comparison of angular velocity between input gear (the one that transfers energy) to output gears gives the gear ratio. When multiple gears connected together, conservation of energy is also followed.

A DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power [11]-[12]. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings.In a geared DC motor the gear connecting the motor and the gear head is quite small, hence it transfers more speed to the larger teeth part of the gear head and makes it rotate.

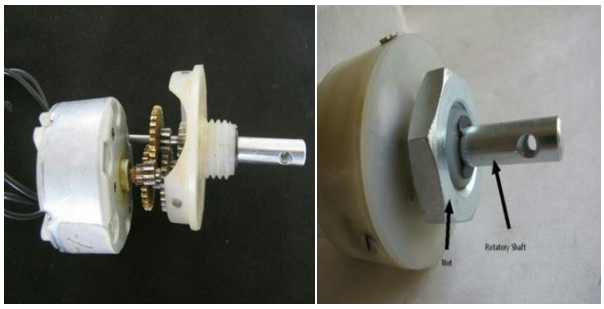

Fig 5: DC Geared Motor

Figure 5 illustrates the outer structure and internal gear mechanism of the DC geared motor

V. LIQUID CRYSTAL DISPLAY

In this, the liquid crystals have thread-like shapes: the units join head to tail for million molecules to form lengthy chains. Moreover each plane is twisted a few degrees from the next. The property of the liquid is anisotropic in the two perpendicular directions. The cell thickness is so designed that there is a 90^0 turn of the molecules between the top and the bottom faces. The twisted pneumatic has the property that twists light, which passes through it. Polaroid filters are fitted above and below the cell so that light is polarized as it enters, and is twisted through 90^0, exiting through a filter kept at 90^0 to the one at top. The light is then reflected via a mirror at the back and returns via the same pathway [9].

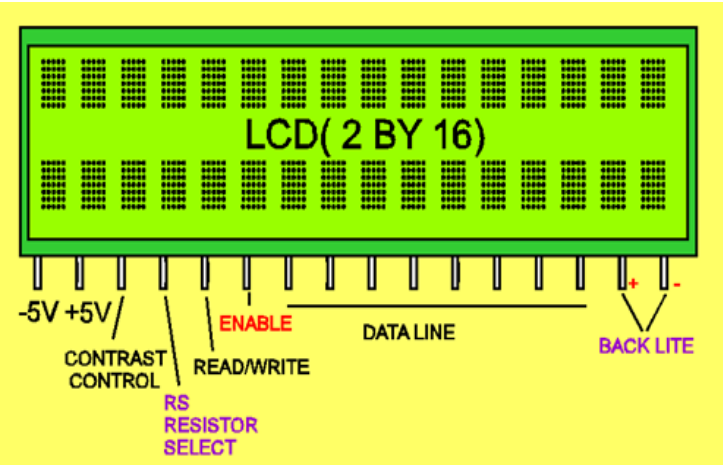

Fig6: Liquid Crystal Display

Figure6 illustrates that this is used to display the positioning of the rotor mechanism and activation of the sensor.

VI. CLAP SWITCH

A circuited switch, which operates with sound of clapping hands or something similar; i.e. the switch comes to 'on' position when clapped once or twice, and to ‘off' position when again clapped once or twice (depends on circuit design). A clap -switch circuit is a sound sensitive circuit [11]. The operation of the circuit is simple.In this circuit we use condenser mike and four transistors with few resistance and capacitor. It converts the energy generated by the “handclap” into electrical pulse, which is in turn used to drive an electronic circuitry that includes a relay [9], which in turn switches ON/OFF any appliance connected through it to the main. The device is activated by clapping twice within a set time period that is determined by a time constant (RC) component value in the circuit [10]. When we give a clap sound in the front of mike then DC bulb is on/off according to sound. In this circuit we use four-transistor circuit. Firstly mike converts the sound signal into electrical signal. This electrical signal is very low and it is not able to switch on/off any bulb [12].We amplify this signal by using one transistor T1. Signal is coupled to the base of transistor through C1 capacitor emitter is forward bias and connected to the negative voltage.Collector is reversed biased through 33k ohm resistance. Amplified signal is available on collector point. Output of one transistor is connected to next circuit. Next circuit is multi vibrator circuit. For multi vibrator we use two transistors one is T2 and second is T3. Multi vibrator make a provision that at a time only one transistor is on Either T2 is on or T3 is on.Working of multi vibrator is depending on the working of T1. Bulb is connected to the Transistor T4. Transistor t4 is operated by transistor T3. When transistor T3 is on then Transistor T4 is automatically on. Now on the next clap T1 again amplify the signal Multi vibrator switch off the transistor T3 and Transistor T3 is switch off the Bulb circuit.

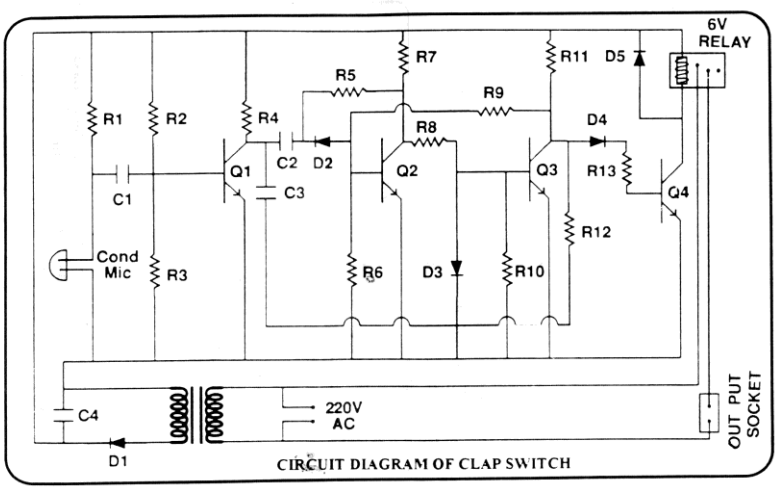

Fig7: Circuit Diagram of Clap Switch

Figure7 Illustrates the circuit diagram of the Clap switch in which when we give a clap sound in the front of mike then DC bulb is on/off according to sound.

The major advantage of a clap switch is that you can turn something (e.g. a lamp) on and off from any location in the room (e.g. while lying in bed) simply by clapping your hands.

VII. RESULT AND DISCUSSION

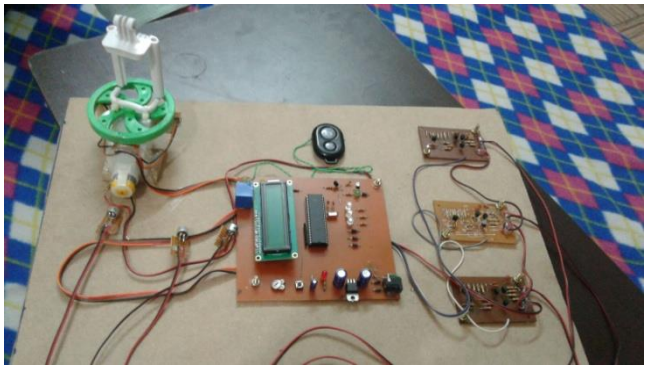

Fig 8: When the power supply is not given.

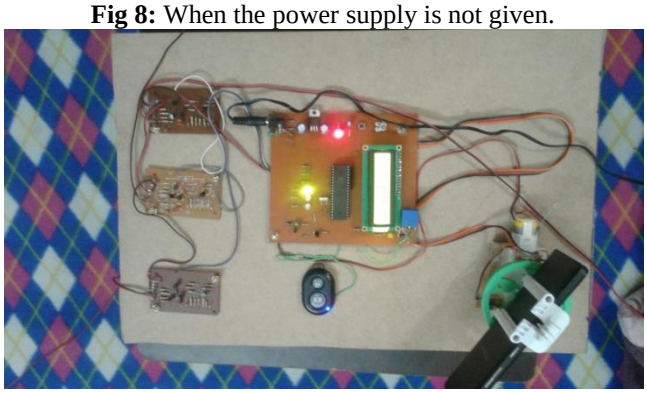

Fig 9: when the supply provided, the LED bulb and LED display glows.

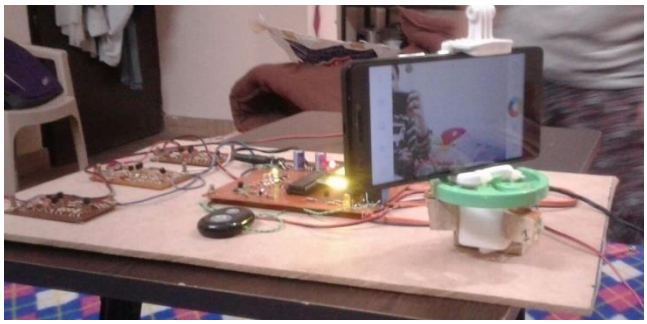

Fig 10: Rotor rotates and captures the snap in the desired direction.

Table1: Output Table.

Applicant	Sound signal	LCD Display	Rotor Position	Direction	Output
Absent	No Signal	NA	0◦	NA	No Snap
Present	Clap Sound	1	120◦	CW	Snap
Present	Clap sound	2	120◦	CW	Snap
Present	Clap sound	3	120◦	CW	Snap

The circuit built on a vero board with successful implementation and desired output.

1. Red and Green LEDs are used in the project.
2. A red LED is used to indicate the power ON and green LED is used to indicate the activated position of reed sensor. When the first signal goes through, generates the output, the green LED glows.
3. DC geared motor is used instead of servo motor to get satisfied results with no errors.
4. The relay is used here to provide the switching mechanism.

VIII. CONCLUSION

The goal of designing a platform for camera which can turn its direction to face wherever a nearby hand clapping or other impulses detected. Since our band pass filter is from the range of 150 hertz to 800 hertz, so the sound with greater frequency or lower frequency will not affect the circuit. This could help to eliminate the sound but on the other hand, if clapping frequency is not in the range will also lead to miss of detection. When a person claps more than once in the same direction, this platform instructs the camera to take picture for each claps detected. We have achieved our goal; our current system could detect the sound even in the noisy environment and could control the camera taking pictures if we clap our hands once or more in the same direction. Since our band pass filter is from the range of 150 hertz to 800 hertz, so the sound with greater frequency or lower frequency will not affect the circuit. This could help to eliminate the sound but on the other hand, if clapping frequency is not in the range will also lead to miss of detection. Sometimes camera could not face to the right direction with one clapping, so it needs another clap to correct the direction. In this project, we use DC geared motor has a greater advantage with the power supply and motor has a movement range of 360 degrees due to which camera can rotate completely free to capture the pictures or selfie in the desired direction.

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AUTHORS BIOGRAPHY:

Simrat Singh Gill (simrat.gill@gmail.com) Assistant professor in the department of electronics and Communication Engineering at M.I.T Moradabad. He has completed his master's degree in the field of communication system and bachelor's degree in electronics and communication engineering at M.I.T Moradabad. His main research interest lies in the area of wireless communication, wireless sense network, MIMO system, Robotics and Embedded system. In recent year, he focused on using modern wireless techniques for developing project based on embedded system. He has published five papers in journal and more than ten conference papers. He is working as a project coordinator from last ten years.

Sumna Khan (khansumna786@gmail.com) Student of Electronics and Communication Engineering, Moradabad Institute of Technology, Moradabad, Uttar Pradesh (244001), and Area of interest includes Robotics and Software applications (Android).

Sanyam Saxena (sanyamsaxena310@gmail.com) Student of Electronics and Communication Engineering, Moradabad Institute of Technology, Moradabad, Uttar Pradesh (244001), and Area of interest includes Robotics and Embedded system.

Shivani Rajput (shivanirajput66@gmail.com) Student of Electronics and Communication Engineering, Moradabad Institute of Technology, Moradabad, Uttar Pradesh (244001), and Area of interest includes Pspice and Embedded System.

Shubham Kumar (shubchauhan13@gmail.com) Student of Electronics and Communication Engineering, Moradabad Institute of Technology, Moradabad, Uttar Pradesh (244001), and Area of interest includes Hardware Development and Robotics.