A Model Based Approach for Human Recognition and Reception by Robot

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Abstract: *In this paper we have introduced a model based approach for human recognition and reception by designing simple robot that can scan people and wish them politely. This robot finds application in offices, malls, parks and functions where it can attract people. The robot rotates its head at an angle of 180˚ and scans for people. If it observes any people within its range, then it wishes them with a pre recorded and message and "Namaste" with hand movements – an Indian traditional method of wishing people. This paper provides the design of a simple low cost service robot which acts as a good welcoming host.*

Keywords: *robot, motion planning, ping sensor, servos, Arduino development board.*

INTRODUCTION: A robot is a mechanical or virtual agent, usually an electro-mechanical machine that is guided by a computer program or electronic circuitry. Robots have replaced humans in the assistance of performing those repetitive and dangerous tasks which humans prefer not to do, or are unable to do due to size limitations, or even those such as in outer space or at the bottom of the sea where humans could not survive the extreme environments.

In this paper, we provide the design of a simple robot that performs the repetitive task of welcoming people both by recorded voice message and by hand movement representing "Namastae" in its coverage area.

This paper helps in designing a robot that can stand at the entrance and wish each and every person within its reach. The idea of a robot greeting people an Indian traditional style, along with a hand movement indicating "NAMASKAR" appeals to people. Children attending the function also will be more eager and excited at being received by a robot.

BLOCK DIAGRAM OF ROBOT:

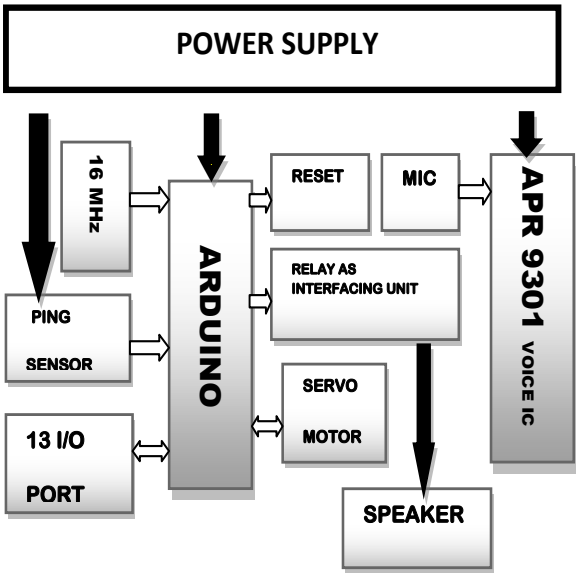

FIG 1: Block diagram of Namaskar Robot with voice

Figure1 represents the block diagram of the Namaskar robot with voice. The description of each block is as follows:

Power Supply **–** It supplies 5V to all the required blocks.

Sensor: An ultrasonic sensor HC-SR04 called ping sensor is used to scan and calculate the distance of a person from robot. It contains a transmitter, control unit and a receiver. It is a low cost sensor.

Voice Playback IC: This IC is used to play a recorded voice message whenever the robot identifies a person passing before it .

Relay **-** It is an electrically operated switch.

Microphone**:** converts energy from one form to another. Microphones convert sound energy into electrical energy.

Microcontroller: A microcontroller is an IC chip which contains a processor, and memory to save program, I/O controls.

MICROCONTROLLER BASED ON ARDUINO:

Arduino is an open-source physical computing platform based on a simple Microcontroller board. It can be used to develop interactive objects. It takes inputs required to devices and controls the o/ps based on inputs. It is simple open source software obtained at low cost. [1]

INTERFACING THE PING SENSOR WITH ARDUINO:

For interfacing the ping sensor to the Arduino board there are 4 pins present in the Arduino board they are

V_{CC}; GROUND; TRIGGER; ECHO

The pins 12 & 13 are the I/O pins that are present on the Arduino Uno board (D-0 to D-13) [2]. Fig2 shows the connections from ping sensor to Arduino board.

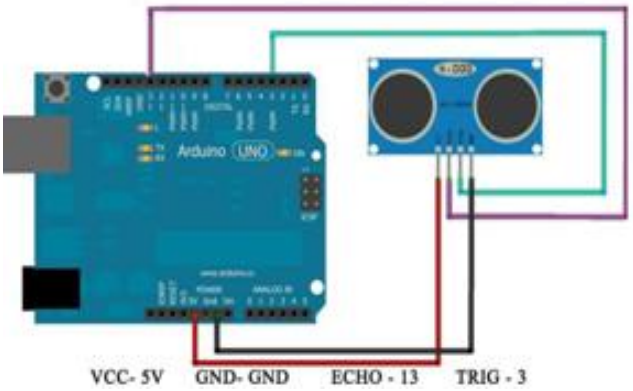

FIG 2: Connections from ping sensor to Arduino board

The ping sensor acts as eyes to the robot. The robot will detect the presence of people within a range of 200cms and will generate an echo signal. This signal is sent to the Arduino development board via I/O port. Then the LED turns ON for the time delay. The distance from sensor to the people is measured and displayed on serial monitor on the Arduino software. The measured distance is sent to the computer using Serial protocol, and the LED is turned OFF to indicate successful reading. A delay of 50msec is given for the next person to be sensed. If there are no people or if they are not within the range of the robot, then LED is switched OFF and it remains immobile.

INTERFACING THE SERVOS WITH AURDINO:

To Control a servo we need to apply a pulse once every 20 milliseconds. The duration of this pulse will determine the Servo Angle. For most Servo's a Pulse duration of 1ms will set the shaft position to 0˚ and a pulse duration of 2 milliseconds will set the shaft position to 180˚[3].

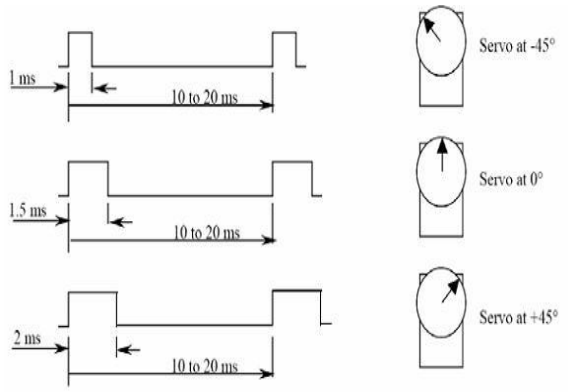

FIG3: Pulse output from error amplifier

Controlling Servos with an Arduino: Arduino provides us with a servo control library that lets us control servos with ease. The library provides us with an option of writing both microsecond's value and angle values. In this paper we used five servos to control the movements of the robot i.e., head, right shoulder, right elbow, left shoulder and left elbow. Figure 11 represents the digital I/O pins D5, D6, D9, D10, D11 in the Arduino board connected to servos.

Servo 1 - D6 - head rotation
Servo 2 - D5 - left elbow
Servo 3 - D11 - Right elbow
Servo 4 - D9 - left shoulder
Servo 5 - D10 - Right shoulder

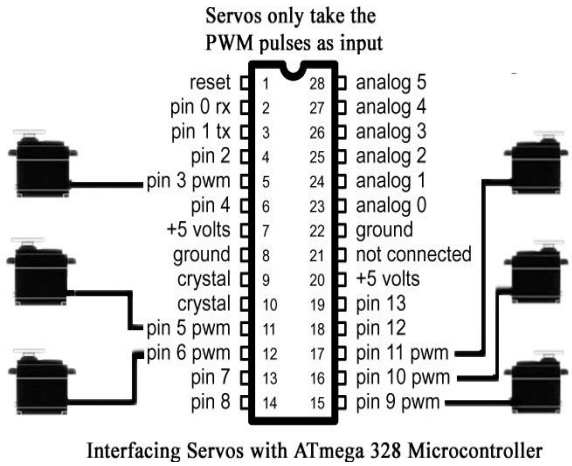

FIG 4: Pin connections from Arduino to Servos

SIMULATED RESULTS:

In this section, the working of the robot is shown in a step wise manner with the simulated results.

Figure 5 shows that the robot is in initial state. i.e. the servos 2,3,4,5 of the robot are in '0°' state or OFF state. The Servo1 is turned ON for 15ms and operated in HIGH state. The head of the robot rotates from centre to left and back to centre, then to right and back to centre. The servo1 provides the angular rotation of head up to 180˚. The movement of the head indicates that the robot is searching for an obstacle.

When any obstacle is sensed by the Ping sensor which acts like eyes of robot, the head position returns to the centre and Servo1 remains at 90˚ angle and turns OFF and is operated in LOW state as shown in Figure 6.

Once the Servo 1 turns OFF, the Servos 4 & 5 turns ON and switches to HIGH state i.e. the signal line is activated for the left and right shoulders of the robot.

Now the hands of robot can make movement upwards. The shoulder servos are connected to the Arduino Digital I/O pins (D9, D10). For these pins the signal line is high and the position of the servo is changed by an angle of 90˚ as shown in the Figure 5. Now the Servos 4 & 5 turns OFF.

Once the Servos 4 & 5 turn OFF, the signal line of Servos 2 & 3 turns ON and provides movement of elbows to the robot. In order to move the elbow gracefully a time delay of 15µs is provided for both the servos. If there is no time delay then the

movement will be very fast and will appear in an odd manner.

The robot now represents the Namaste position after the 90 degrees of high motion from the shoulders then the action of the elbow movement starts and represents the Namaste position as shown in Figure 7. A delay of '3' seconds is applied. The digital pins that are used for the elbow movement are (D5, D11). At all these cases the position of the head is in 90 degrees and basically in the OFF state. All these actions depend upon the signal line that comes from the Arduino Uno board.

After 3 second delay the robot returns to the positions as shown in figures 8&9.[d] position. The -45 degree of operation is performed.

This is the final view that is observed. All the servo lines are set to zero (D5, D11, D10, and D9) are down to OFF state. And the 'D6' digital pin is HIGH that which is used for the head rotation is performed and the PING again starts searching for the obstacle panning from left to right. Figures (5, 6, 7, 8, 9) shows the different stages of gesture movements of the robot.

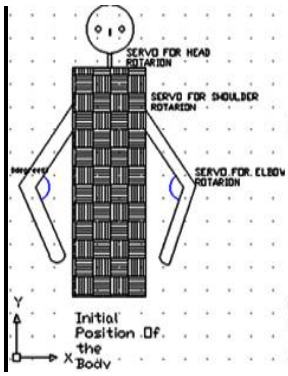

FIG5: INITIAL POSITION OF THE ROBOT

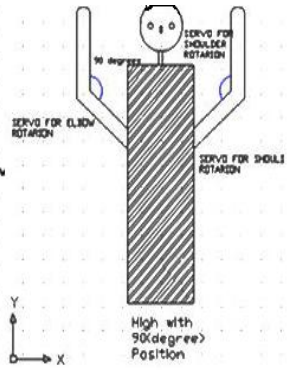

FIG6: SHOULDER MOVEMENT OF THE ROBOT

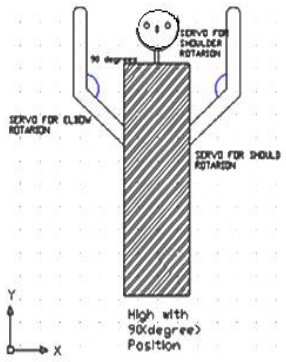

FIG:7 NAMASKAR POSITION AFTER ELBOW MOVEMENT.

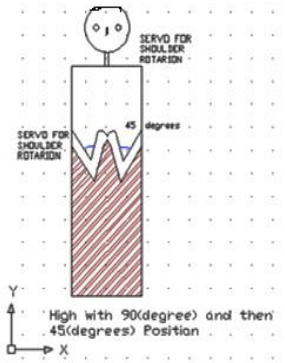

FIG8: SHOULDER POSITION BACK AFTER 3 SEC DELAY

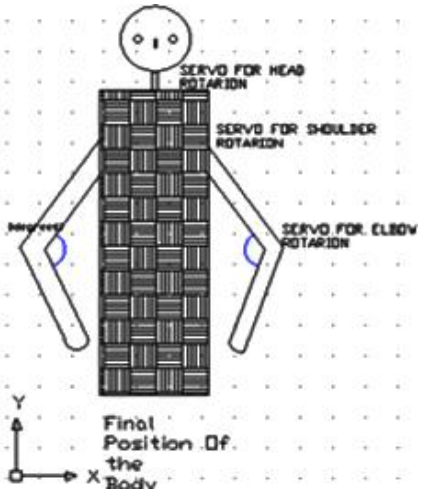

FIG 9: ROBOT RETURNING TO INITIAL POSITION.

8. CONCLUSION:

The main aim of this paper was to design a "Namaskar robot" which provides the service of welcoming people graciously. This is a low cost service robot which can be designed and used in public places, functions, parties etc which attracts a lot of attention from kids as well as adults.

10. REFERENCES:

1.http://dlnmh9ip6v2uc.cloudfront.net/learn/materials/1/Arduino_final_handout.pdf

2.http://ap.urpi.fei.stuba.sk/sensorwiki/index.php/Acrob015

3. http://www.instructables.com/id/Arduino-based-Robotic-Manipulator/