ARDUINO CONTROLLED SAFETY WARNING ROBOT

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ABSTRACT

Robotics is part of today's communication. In today's world robotics is a fast growing and interesting field. It is simplest way for latest technology modification. Just as robots will change healthcare, manufacturing, and the military, robots have the potential to produce big changes in safety areas. Now-a-days communication is part of advancement of technology, so we decided to work on robotics field and design something which will make human life simpler in safety aspect. Many people have died due to electric pole shocks or by touching high voltage utility poles. No proper warning or signs near such areas lead to big accidents even costing human lives.

To overcome this type of problem, we have come up with a simple yet effective safety warning robot which is controlled using arduino. This robot is mainly applied in the safety aspect or in dangerous conditions where people like police find it difficult to solve. Safety warning robots may decrease dangers to police officers by removing them from potentially volatile situations. This safety warning service robot will scan people using IR Sensors. When a person or animal gets potentially closer to the object, this robot will move its one arm with stop sign indication attached using servo motors and yells to move back using the speaker and the message that is already stored in the voice playback. People or animals going closer to dangerous objects like transformers, electricity wires, voltage utility poles can be avoided by using this safety warning robot. This robot can be modified and used as a party robot by changing the voice playback and the doll used.

I.INTRODUCTION

1.1 INTRODUCTION OF PROJECT:

The main objective of this project is to develop a safety warning robot that helps people avoid danger. It uses arduino uno along with servo motor and also a voice playback that plays the message that we pre-recorded and plays through its speaker. A robot is a mechanical or virtual agent, usually an electromechanical 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 humans could not survive in the extreme environments. Modern robots are classified into different categories such as mobile robots, Commercial or industrial robots, cobots or service robots based on their performance features. Robot is a machine that looks like a human being and performs various complex tasks. There are many types of robots such as fixed base robot, mobile robot, underwater robot, humanoid robot, space robot and medicine robot etc. In this project a SAFETY WARNING ROBOT is developed. This robot is equipped with a IR Sensor used and feeds the signals to the microcontroller in order to trigger the arm that is connected through servo motor which in turn moves the arm and indicates stop sign and plays a voice recorded through speaker. This robot is controlled using arduino uno. This robot implements the concepts of environmental safety warning, proportional servo motor control and motion sensor using IR Sensors. The motor driver is used for the unidirectional control of the servo motor equipped in the robot. Every instruction for motion control is given to the robot with the help of Arduino Uno. Each technology has its own unique features and benefits that makes some more suited to particular applications, whilst others can be seen for all other safety related applications. This robot could be modified and used as per requirements.

1.2 PROBLEM STATEMENT:

Firstly, electricity poles or utility poles appear to constitute one of the major roadside hazards. The data indicates that accidents due to utility poles are one of the most frequently caused accidents worldwide. Assessing and resolving the utility-pole accident problem is a formidable task. Contributing factors that make the problem difficult includes sketchy accident statistics, lack of uniform standards and enforcement for locating utility poles, insufficient legal authority for states to undertake corrective action, inadequate right-of-way in many areas, and the high cost of human labour that cannot be employed in such situation due to security and safety aspects. Secondly many areas have extreme temperatures and employment of humans or officers or guards to look after dangerous situations has made it even more difficult to solve this problem. It not only serves a threat for people but also for animals that unknowingly enter dangerous places and get hurt. In all such cases it is very difficult to deploy any person. All these problems can be resolved using a safety warning robot that does all the work required and ensures that no human or animal is harmed. In this way we could reduce the burden of safety by deployment of human as well as ensure extreme security.

1.3 MOTIVATION OF PROJECT:

The design of arduino based safety warning robot is done by using arduino uno microcontroller using IR sensor for motion detection and servo motors for arm movement and speaker that works as output for the message that we need to put out. The purpose of this safety warning robot, as the name suggests is to provide safety warning to people and animals when they come in near contact to any dangerous poles like electric poles, high voltage poles, utility poles that have potential to produce shock and cause accidents. And our motivation to develop this project is to design a low cost robot with friendly functionality that could be deployed in dangerous situations and lessen the burden for humans.
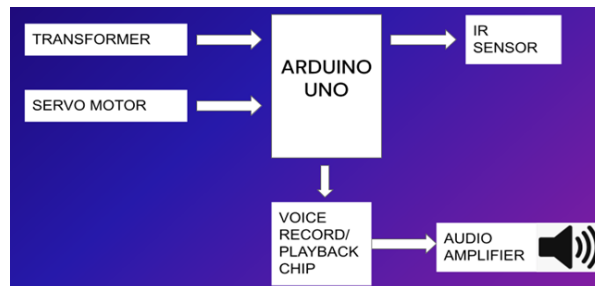
1.4 BLOCK DIAGRAM

Fig. 1.1 Block Diagram of Arduino Based Safety Warning Robot

Figure 1.1 depicts the block diagram of our project which is a arduino uno controlled safety robot. This robot is developed using arduino uno, ir sensors, servo motor, a voice record/playback chip, transformer and a audio amplifier. The arrows indicate whether the components feed the signal to the microcontroller or accept the signal given by the microcontroller. In our project, IR sensor and transformer act as inputs whereas servo motor and speaker act as outputs.

Each block has separate function to do and all the blocks work with the central brain of project i.e the microcontroller arduino uno. Power supply, connecting wires, doll/robot face, a circuit board are used to complete the circuit. The IR Sensor senses any person/animal coming closer to the robot and feeds the signal to microcontroller which in our project, is arduino uno. This arduino uno microcontrollers triggers the servo motor and the motion of hand indicating the

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stop symbol is moved, which in turn triggers the voice recording/playback and the message," Beep! Danger ahead, danger ahead" is heard through the speaker.

II.LITERATURE SURVEY

S[1] " Dheeban S S, Harish D V, Hari Vignesh A, Prasanna M (2018 IEEE) " "Arduino Controlled Gesture Robot ". In this paper, we have proposed an arduino controlled gesture robot. Nowadays robotic arm is used in various areas such as military, defense, medical surgeries, pick and place function in industrial automation applications. Based on the gesture of human hands the robotic arm moves and performs the task and this system replicates the actions of human hands. The arm is very flexible and can be made suitable in places where the environment is not safe for humans like firework manufacturing industry, bomb diffusing etc. There are various techniques for controlling the robotic arm. This paper deals with the accelerometer-based gesture recognition for controlling the movements of the robotic arm through wireless control by using Zig- bee protocol.

S[2] " G Sheela, Dr. S. Priya, Dr. A. Suresh (2018 IEEE)" "ARDUINO CONTROLLED HANGING ROBOT FOR INDUSTRY MONITORING USING WIRELESS ZIGBEE" This project proposed an ARDUINO controlled system for safety purpose robot using wireless ZigBee. The robot has sensors for detecting gas leakage. The MQ2 smoke sensor is sensitive to smoke and following gases are, LPG, Butane, Methane, Alcohol, Hydrogen. Automatically send the sensor information to more number of places using ZigBee mesh network. The system also provide any abnormal change in the parameters gives an alert using buzzer for the safety and security purpose. The robot movement can be controlled by without human work using wireless ZigBee. This type of robot easily working in dangerous places.

 S[3]" Ihsan A. Taha, Hamzah M. Marhoon (2013) proposed that the wireless control systems are taking a special importance in the recent years, where the wireless control system provide several advantages; including the disposal of the using wire and periodic maintenance of data transmission wires, in the science of robot wireless control unit is the main part of the fire treatment and extinguish robot system. The lives of firefighters exposed to the risk of death and Rima, therefore the use of remote control systems more secure is necessary. In this, paper a fire-extinguish robot used for extinguishing the fire in general and in treatment fires in the closed areas for protecting employees in the field of fire suppression from combustion, exposure or inhalation to the toxic gases. The basic idea of fire detection and treatment robot based on detect the fire by the wireless camera and flame sensor then suppression the fire by send command from mobile phone through Bluetooth connection to make water pump turn "ON", and the fire then extinguished.

S[4]" Ekeh Godwin E, ; Afolabi Yinka Idris, Anyanwu Onyekachi Julian (International Journal of Innovative Information Systems & Technology Research 9(2):62-69, April-June, 2021)" "Obstacle Avoidance and Navigation Robotic Vehicle using Proximity and Ultrasonic Sensor, Arduino Controller" Obstacle Avoidance and Navigation Robotic Vehicle is an intelligent robot that automatically senses,scans and directs itself to overcome obstacles on its path. The system uses the proximity sensor and ultrasonic sensor to detect and locate obstacles on its path and navigates to an obstacle-free path. This technique is designed to sense obstacles on its path, apply brakes automatically, scans its environment and take a safe route in order to avoid unpredicted danger. This robotic vehicle is a microcontroller based system which is useful in automobiles as an intelligent vehicle assistant for safe driving. The system is designed using C programming language and Arduino Software (IDE) and uploaded on Arduino board. Ultrasonic sensor was used to detect an obstacle in front of the vehicle while the proximity detector/sensor to identify

an obstacle behind the vehicle. The sensors send the data collected to the Arduino controller which compares and directs the motor-driver to move the vehicle

S[5]" J Jalann, D Misman, A S Sadun and L C Hong in 2016 – ICROM" "Automatic fire fighting robot with notification" In real life, fire accidents can happen anytime and anywhere that usually hardly controllable.Therefore the fire security is important to human life. Note that the human is difficult to detect the fire in the location that is hard to reach or see by a human. Moreover, the human also may take a lot of time to extinguish fire due to the fact that finding a water source can be troublesome. Therefore, an automatic firefighting robot has been designed and proposed in this study. This robot used 3 flame sensors to detect the fire. It also equipped with 3 ultrasonic sensors for obstacle avoiding which protecting the robot and the internal components from any obstacles. Each sensor on the robot is controlled by the Arduino. Apart from the sensors, the robot is also equipped with the water tank that provides water once the fire is detected. The robot will move randomly in the room when the power is on. When the flame sensors detected the fire, the robot will move to the fire source and send a warning message to the user. Once the robot reached the burning area, it will stop at a certain distance and extinguish the fire by using water.

III.DESCRIPTION
3.1 TECHNICAL DESCRIPTION
3.1.1 ARDUINO UNO:
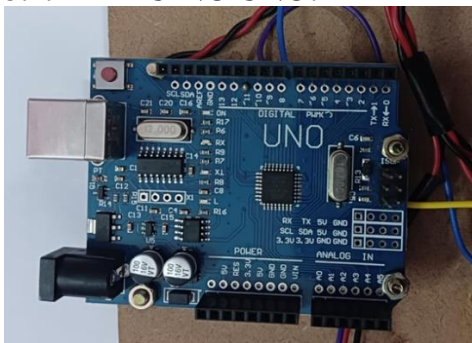
The Arduino Uno is a microcontroller board based on the ATmega328. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

"Uno" means "One" in Italian and is named to mark the upcoming release of Arduino 1.0. The Uno and version 1.0 will be the reference versions of Arduino, moving forward. The Uno is the latest in a series of USB Arduino boards and the reference model for the Arduino platform To control the Arduino Uno board, the user has to write instructions in human-readable form on the Host PC and convert it into machine language and upload it to the board. This whole process is carried out.

3.1.2 IR SENSOR:

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An infrared proximity sensor or IR Sensor is an electronic device that emits infrared lights to sense some aspect of the surroundings and can be employed to detect the motion of an object. As this is a passive sensor, it can only measure infrared radiation.

An infrared sensor is an electronic module which is used to sense certain physical appearance of its surroundings by either emitting and/or detecting infrared radiation. IR sensors are also capable of determining the heat being emitted by an object and detecting motion. Now lets learn the interfacing of IR Sensor and Arduino.Here we are using an IR sensor for detecting obstacles. IR transmitter transmits IR signal, as that signal detects any obstacle in its path, the transmitted IR signal reflects back from the obstacle and received by the receiver.

3.1.3 SERVO MOTOR:

Servo motors are great devices that can turn to a specified position. Usually, they have a servo arm that can turn 180 degrees. Using the Arduino, we can tell a servo to go to a specified position and it will go there. Servo motors were first used in the Remote Control (RC) world, usually to control the steering of RC cars or the flaps on a RC plane. With time, they found their uses in robotics, automation, and of course, the Arduino world.

A servo motor is a type of motor that can rotate with great precision. Normally this type of motor consists of a control circuit that provides feedback on the current position of the motor shaft, this feedback allows the servo motors to rotate with great precision. If you want to rotate an object at some specific angles or distance, then you use a servo motor. It is just made up of a simple motor which runs through a servo mechanism. If motor is powered by a DC power supply then it is called DC servo motor, and if it is AC-powered motor then it is called AC servo motor.

3.1.3.1 SERVO MOTOR SG90:

Micro Servo Motor SG90 is a tiny and lightweight server motor with high output power. Servo can rotate approximately 180 degrees (90 in each direction), and works just like the standard kinds but smaller. You can use any servo code, hardware or library to control these servos. Good for beginners who want to make stuff move without building a motor controller with feedback & gear box, especially since it will fit in small places. It comes with a 3 horns (arms) and hardware.

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3.1.4 VOICE RECORD/PLAYBACK:

Voice Recorder is a device that captures speech (or audio) in various situations like meetings, lectures, interviews, conferences, broadcasts etc. so that you can easily edit or play them back. There are different types of hardware and software dedicated to voice recording that provide several customization options.

3.1.4.1 ISD1820 Voice Recorder Module:

ISD1820 Voice Recorder Module is based on the ISD1820 IC, which is a single chip Voice recorder IC for single message record and playback. I am not sure about the availability of only the IC but it is frequently found in the module with all the necessary components and circuitry. A major feature of the ISD1820 Voice Recorder Module is that is can store the messages in its non-volatile memory and can be configured to store messages of length between 8 Seconds to 20 Seconds. The ISD1820 Voice Recorder Module used in this project is shown below. As you can see, there are a lot of components on the board that help the ISD1820 IC in recording and playback.
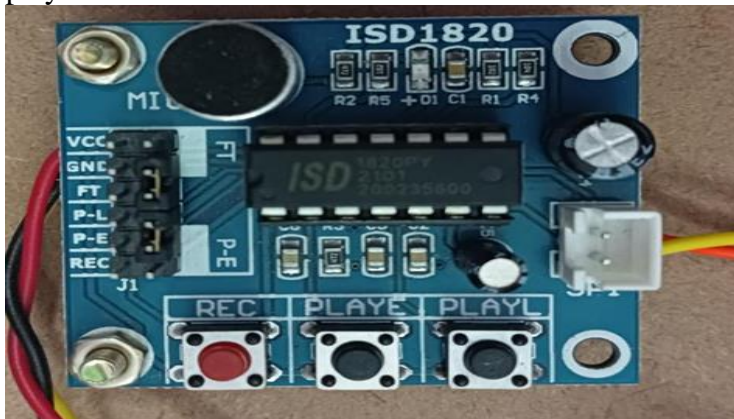
3.1.5 SPEAKER:

Speakers have specifications in terms of their sensitivity and efficiency— their ability to convert the incoming electrical energy into acoustical energy. Dynamic, moving coil speakers (the type found in most guitar and bass amps) are notoriously inefficient, and most of the incoming power is actually converted into heat, not sound. Normally, speaker sensitivity is measured in an anechoic chamber (non-reflective, soundproof room) and expressed something like this: 90 dB @ 1W/1m.

3.1.5.1 10W Speaker:

Gives the output voice recorded message.

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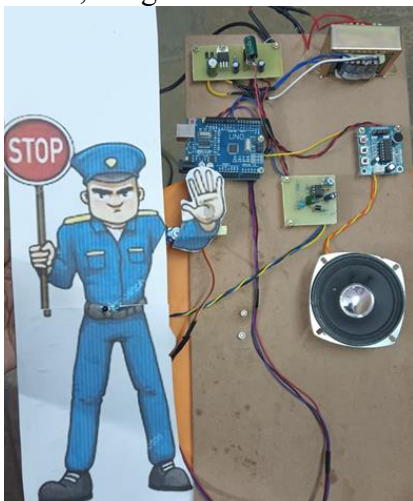|	
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3.2 METHODOLOGY

The methodology of this project design includes implementation of the proposed method. There are some basic steps involved in the Methodology of the product. The first major step is setting up the IR Sensors to the doll or robot face that we want to use. Depending on the range that we want the device to detect, the IR sensors could be fixed either on the dolls head or hip area. Second step begins by attaching the servo motor to the dolls hand to get the 90 degree rotation of the hand and place a stop sign. The third important step is to pre-record the voice message that we want to tell by using the recoding button of voice record and playback. Hold both buttons for a few seconds and yell the message that you want to record and it will be played from the speaker as output. By following these three important steps and verification of code and fitting of doll on circuit board, the implementation of the proposed system is going to be done.

3.3. PROCEDURE

The project begins when a person or animal starts walking towards the dangerous situation where this robot is deployed. The IR Sensors installed on the face of robot scans the person/animal and feeds the signal to the arduino uno microcontroller. This arduino uno microcontroller after receiving the signal, it triggers the servo motor which motions of hand indicating the stop symbol is moved, which in turn triggers the voice recoding/playback and the message," Beep! Danger ahead, danger ahead" is heard through the speaker.

IV.SYSTEM ANALYSIS
4.1 EXISTING SYSTEM

Robots have replaced human in performing repetitive and dangerous tasks which humans prefer not to do, or are unable to do because of size limitations, or which take place i n extreme environments such as outer space or the bottom of the sea. The advent of new high-speed technology and the growing computer Capacity provided realist ic opportunity for new robot controls and realization of new methods of control state. This technical improvement together with the need for high performance robots created faster, more accurate and more intelligent robots using new robots control devices in recent years, the applications of mobile robot have gradually become more diverse, which makes the robot closer to people's daily life. Robots are now almost in all sectors like healthcare, military, under water. These robots are deployed to solve human problems in a better way which is safe and also very much faster. Robots deployed for safety aspect are very less and not utilised to their best of their capabilities. Transferring some materials can be harmful or the field itself could be dangerous, for example in the chemical factories, the military industries and in any critical transfer process, controller errors could cause damage. Existing systems have only focused on obstacle detection and prevention and did not include any safety warning aspect in them. Keeping in mind all these things, we have proposed our solution.

4.2 PROPOSED SYSTEM

One such solution that could include robots as well as help people or protect them was this – Safety warning robot controlled by arduino uno. This project is to develop a model of a product or a prototype of a robot that could help avoid accidents and help humans in the safety sector. The top goal on the far side of this project would be, to be able to build a product that may hopefully enable individuals to ensure safety in various situations, act as a multipurpose robot that could be reused for many occasions and prevent any kind of human accidents and as well as save animals lives.

Few of the Key points of our proposed system are as mentioned below –

1. Beep sound with message which is very loud because of speaker attached that scares away the animals that come near to the dangerous object.
2. Servo motor controlled gesture of one arm with stop sign helps birds and other creatures to not get into accidents.
3. Combined 1 & 2 together helps to keep people away from safety priority zones.
4. This robot can be recycled and just by changing the doll face and arm sign you can reuse it in many occasions.
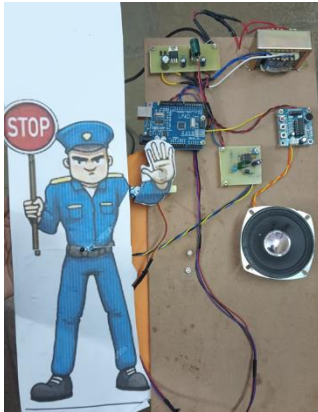
V.RESULTS
5.1 Result of Arduino Controlled Safety Warning Robot:
5.1.1 How the project set-up looks!

Fig 7.1 Project Kit before power supply

7.1.2 Actual result verification:

Fig : Robot doll with power supply and object detection

The doll having ir sensors senses human beings and immediately shakes the hand 90 degrees using servo motor and voice playback comes as output.

OUTPUT MESSAGE THROUGH SPEAKER :-

"Beeeeep! Danger ahead. Step Back! Step Back!"

Advantages:

• It can operate anywhere through the world.

• Safety against dangerous situations.

• It is available at low cost.

• Voice control function.

• Flexibility for new applications.

• Helps policemen to stay safe while does the work.

• Could be used in remote places.

• Simple modifications lead to complete different usage like party welcoming robot, health care robot etc

Disadvantages:

• It only helps in detecting and warning people but does not help to stop them.

• Needs continuous power supply to work.

• Equipment could be broken in extreme conditions.

• Requires maintainence.

Applications:

• Caution places, high voltage utility poles, danger zones, anywhere harmful for people.
• Road construction sites, where they dig deep into earth.
• Electricity plants, thermal plants.
• Pot holes, man holes, sewage holes.

VI.CONCLUSION:

In our work we have implemented a simple and cost-effective robot, which is multi-purpose of the ARDUINO controlled robot in nature. Mainly it is designed for uses of safety aspect. It is used hazardous environment. The Arduino controlled safety warning robot has been experimentally proven to work satisfactorily by giving warning through visual and sound both, warning people and animals of danger and saving them from potential threats. The designed system not only helps in safety situations but also can be reused and modified according to their needs. This will help many people by not letting any guard's life in danger and also completing the said task successfully.

Future Scope:

Using this system as a framework, the system can be expanded to include various other options which could be done by changing the doll face, the arm indication and voice playback.

This project can introduce a service robot which performs the repetitive task of welcoming people graciously both by a sweet recorded message and hand gesture representing "Namaste" – an Indian traditional method wishing of people. Most commonly we observe people dressed in the imitation costumes of Mickey Mouse, Donald duck, Teddy bear etc., near schools, colleges, offices, in parties and marriages etc. Here the people wear only costume and performs the task of wishing unfamiliar people mechanically which is really a mind-numbing task. In future we could design and deploy a service robot that acts as a host in receiving people and performs the same task for hours without getting weary. This will be a low cost flexible robot which can be designed and constructed without difficulty.

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