

An Arduino Based Embedded System in Vehicle for Road Safety

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ABSTRACT

The objective of this project is to control the speed and Vehicle safety automatically with the help RF technology. This Project is very useful to traffic police department. If the speed of the vehicle is over than limit value, the speed is automatically Controlled. So this project this used to prevent the accident In a helmet unit is there is a sensor (Limit switch) that is used to detect that the driver is wear the helmet properly or not. Then this information is transmitting to the microcontroller. Microcontroller checks this information if the helmet properly wears means it allowed to on the vehicle otherwise it turns of the relay to stop the vehicle. Driver circuit used for control the relay.

Keywords: Arduino microcontroller, relay, sensor, RF, driver circuit, alarm.

1. INTRODUCTION

Present industry is increasingly shifting towards automation. Two principle components of today's industrial automations are programmable controllers. In order to aid the tedious work and to serve the mankind, today there is a general tendency to develop an intelligent operation. The proposed system "ACCIDENT PREVENTION USING EYEBLINKING & HEAD MOVEMENT" is designed and developed to accomplish the various tasks in an adverse environment of an industry. The intelligent this project is an owe to the technical advancement. This prototype system can be applied effectively and efficiently in an expanded dimension to fit for the requirement of industrial, research and commercial applications. Microcontroller is the heart of the device which handles all the sub devices connected across it. We have used as microcontroller. It has flash type reprogrammable memory. It has some peripheral devices to play this project perform. It also provides sufficient power to inbuilt peripheral devices. We need not give individually to all devices. The peripheral devices also activates as low power operation mode. These are the advantages are appear here.

1.1 Existing system

At the present time there are few existing systems industry is increasingly shifting towards automation. Two principle components of today's industrial automations are programmable controllers. In order to aid the tedious work and to serve the mankind, today there is a general tendency to develop an intelligent operation. Microcontroller is the heart of the device which handles all the sub devices connected across it. We have used as microcontroller. It has flash type reprogrammable memory. It has some peripheral devices to play this project perform. It also provides sufficient power to inbuilt peripheral devices. We need not give individually to all devices. The peripheral devices also activates as low power operation mode. These are the advantages appear here.

1.2 Proposed System

In this system helmet unit is there is a sensor (Limit switch) that is used to detect that the driver is wear the helmet properly or not. Then this information is transmits to the microcontroller. Microcontroller checks this information

if the helmet properly wears means it allowed to on the vehicle otherwise it turns of the relay to stop the vehicle. Driver circuit used for control the relay. If the alcohol sensor detects that the driver drunk means microcontroller automatically stops the vehicle by means of control the relay through Driver circuit. Driver sleeps stage to detect the IR sensor and indicate the alarm.

2. LITERATURE REVIEW

1. G.Sathya, et al [3] achieved with the help of "AARS using GPRS 3G TECHNOLOGY". IN 2321-2004

We can provide a smooth flow for the ambulance by controlling the traffic light according to the ambulance location to reach the hospital. The location of the ambulance can be easily identified with the help of the GPS unit installed in it. A controller in the traffic junction can automatically control the traffic flow and thus reduces the time delay taken by ambulance to the hospitals. The traffic junction band the ambulance will have GPRS 3G modem to communicate between them. The chances of misusing the ambulance can overcome with the help of an RFID tag given to the doctor's in the respective hospitals so that the security can be attained.. This scheme is helpful for the Traffic police to control the traffic thereby helping the patients who are facing emergency. s of interest. Two such major factors are web browser and GPS services. Both of these functionalities are already implemented but are only in the hands of manufacturers not in the hands of users because of proprietary issues, the system does not allow the user to access the mobile hardware directly.

But now, after the release of android based open source mobile phone a user can access the hardware directly and design customized native applications to develop Web and GPS enabled services and can program the other hardware components like camera etc. In this paper we will discuss the facilities available in android platform for implementing LBS services (geo-services).

2.Majid A.Al-Taee, Nabeel A.Al-saber, Omar B.Khader, Remote monitoring of Vehicle Diagnostic and location using a smart box with GPS and GPRS. 2007 IEEE

In their paper they presents a distributed system for remote monitoring of vehicle Diagnostics and geographical position. This is achieved by using on-board microcomputer system, called on-board smart box (OBSB), general packet radio service (GPRS) and a remote server. The OBSB which is equipped with an integrated global positioning system (GPS) receiver is empowered by a software application that manages the processes of local data acquisition and transmission of the acquired data to the remote server via G.

3. In S.P. Bunker, et al [2] described a real-time online safety prototype that controls the vehicle speed under driver fatigue.2006 IEEE

The purpose of such a model is to advance a system to detect fatigue symptoms in drivers and control the speed of vehicle to avoid accidents. The main components of the system consist of number of real time sensors like gas, eye blink, alcohol, fuel, impact sensors and a software interface with GPS and Google Maps APIs for location PRS.

3. SYSTEM FUNCTION

3.1 BLOCK DIAGRAM

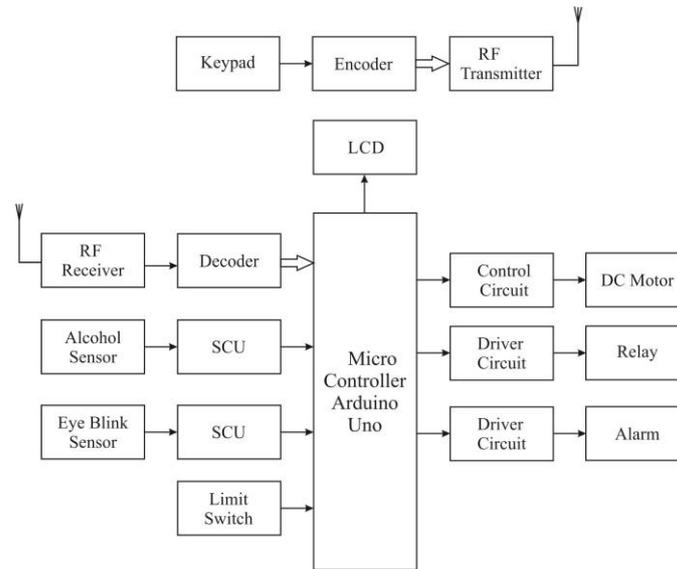


Fig: 3.1 Block diagram of the system

This system consists of:

1. Alcohol sensor
2. IR sensor
3. Limit switch
4. RF transmitter
5. RF receiver
6. Relay
7. Driver circuit
8. ARDUINO Micro controller
9. Alarm

3.2. REGULATED POWER SUPPLY

Block diagram

The ac voltage, typically 220V rms, is connected to a transformer, which steps that ac voltage down to the level of the desired dc output. A diode rectifier then provides a full-wave rectified voltage that is initially filtered by a simple capacitor filter to produce a dc voltage. This resulting dc voltage usually has some ripple or ac voltage variation.

A regulator circuit removes the ripples and also remains the same dc value even if the input dc voltage varies, or the load connected to the output dc voltage changes. This voltage regulation is usually obtained using one of the popular voltage regulator IC units.

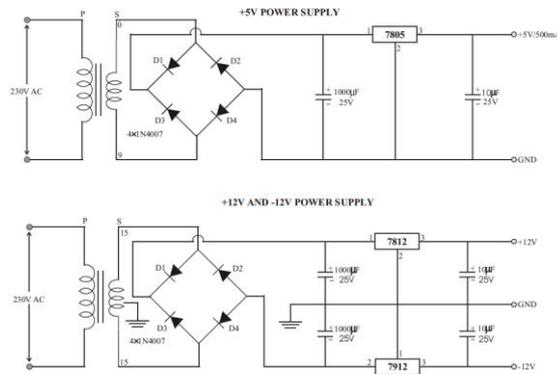
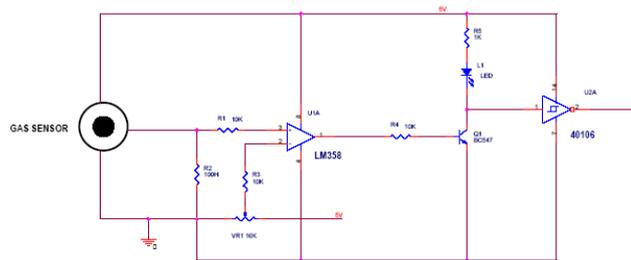


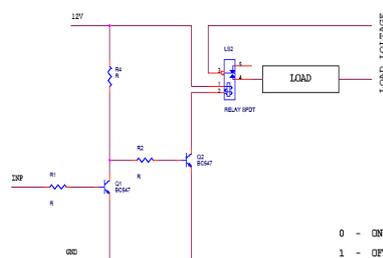
Fig: 3.2 Block diagram (Power supply)

3.3. ALCOHOL SENSOR CIRCUIT



The gas sensor is the special sensor which designed for sense the gas leakage. In the gas sensor the supply voltage is given to input terminal. The gas sensor output terminals are connected to non inverting input terminal of the comparator. Here the comparator is constructed with operational amplifier LM 358. The reference voltage is given to inverting input terminal. The reference voltage is depends on the desired gas intensity. When there is no leakage the non inverting input is grater then inverting input so the output of the comparator is positive voltage which is given to the base of the switching transistor BC 547. Hence the transistor is conducting. Here the transistor is act as switch so the collector and emitter will be closed. The output is taken from collector terminal. Now the output is zero which is given to hex inverter 40106. When there is gas leakage the inverting input voltage is greater than non inverting input. Now the comparator output is -12V so the transistor is cutoff region. The 5v is given to hex inverter 40106 IC. Then the final output data is directly given to microcontroller to determine the gas leakage.

3.4. RELAY CIRCUIT



This circuit is designed to control the load. The load may be motor or any other load. The load is turned ON and OFF through relay. The relay ON and OFF is controlled by the pair of switching transistors (BC 547). The relay is connected in the Q2 transistor collector terminal. A Relay is nothing but electromagnetic switching device which consists of three pins. They are Common, Normally close (NC) and Normally open (NO). The relay common pin is connected to supply voltage. The normally open (NO) pin connected to load. When high pulse signal is given to base of the Q1 transistors, the transistor is conducting and shorts the collector and emitter terminal and zero signals is given to base of the Q2 transistor. So the relay is turned OFF state. When low pulse is given to base of transistor Q1 transistor, the transistor is turned OFF. Now 12v is given to base of Q2 transistor so the transistor is conducting and relay is turned ON. Hence the common terminal and NO terminal of relay are shorted. Now load gets the supply voltage through relay.

3.5. IR SENSOR CIRCUIT

Infrared transmitter is one type of LED which emits infrared rays generally called as IR Transmitter. Similarly IR Receiver is used to receive the IR rays transmitted by the IR transmitter.

One important point is both IR transmitter and receiver should be placed straight line to each other. The transmitted signal is given to IR transmitter whenever the signal is high, the IR transmitter LED is conducting it passes the IR rays to the receiver. The IR receiver is connected with comparator.

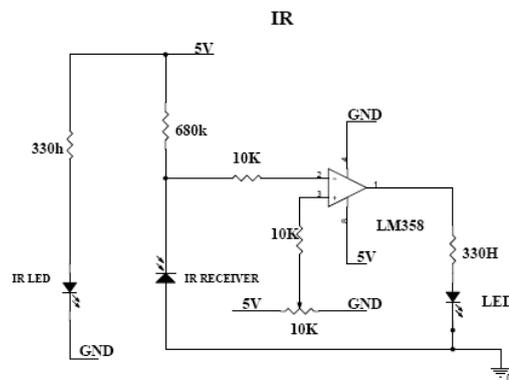


Fig.3.5.Circuit diagram of IR sensor

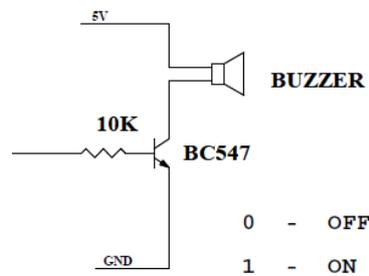
The comparator is constructed with LM 358 operational amplifier. In the comparator circuit the reference voltage is given to inverting input terminal. The non inverting input terminal is connected IR receiver. When interrupt the IR rays between the IR transmitter and receiver, the IR receiver is not conducting. So the comparator non inverting input terminal voltage is higher than inverting input. Now the comparator output is in the range of +5V. This voltage is given to microcontroller or PC and led so led will glow. When IR transmitter passes the rays to receiver, the IR receiver is conducting due to that non inverting input voltage is lower than inverting input. Now the

comparator output is GND so the output is given to microcontroller or PC. This circuit is mainly used to for counting application, intruder detector etc.

3.6. ALARM CIRCUIT

The circuit is designed to control the buzzer. The buzzer ON and OFF is controlled by the pair of switching transistors (BC 547). The buzzer is connected in the Q2 transistor collector terminal. When high pulse signal is given to base of the Q1 transistors, the transistor is conducting and close the collector and emitter terminal so zero signals is given to base of the Q2 transistor. Hence Q2 transistor and buzzer is turned OFF state. When low pulse is given to base of transistor Q1 transistor, the transistor is turned OFF. Now 12v is given to base of Q2 transistor so the transistor is conducting and buzzer is energized and produces the sound signal.

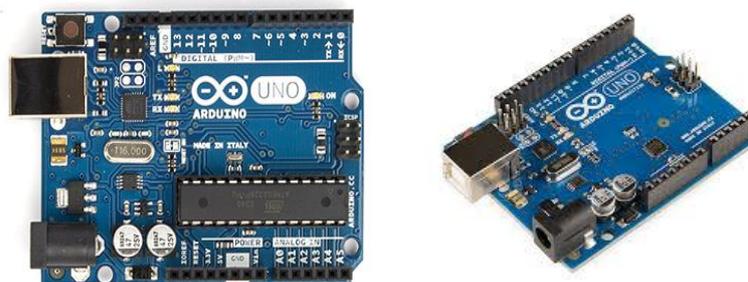
ALARM CIRCUIT



4.HARDWARE REQUIREMENTS AND SPECIFICATION

4.1. ARDUINO UNO Microcontroller

Arduino/Genuino Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, 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 a AC-to-DC adapter or battery to get started.. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again. "Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases.



The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

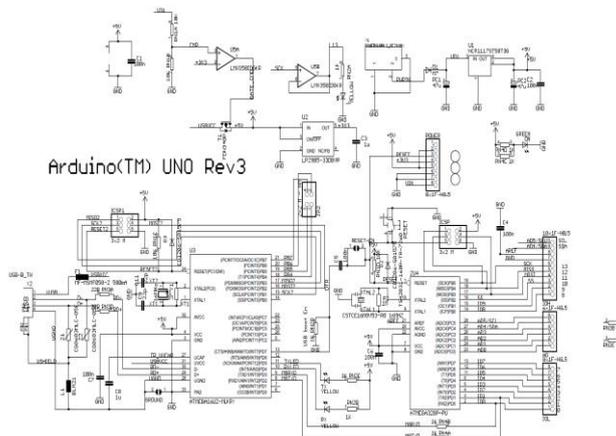
The power pins are as follows:

Vin. The input voltage to the Arduino/Genuino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

5V. This pin outputs a regulated 5V from the regulator on the board. The board can be supplied with power either from the DC power jack (7 - 12V), the USB connector (5V), or the VIN pin of the board (7-12V). Supplying voltage via the 5V or 3.3V pins bypasses the regulator, and can damage your board. We don't advise it.

3.3V volt supply generated by the on-board regulator. Maximum current draw is 50 mA.

GND. Ground pins.



IOREF. This pin on the Arduino/Genuino board provides the voltage reference with which the microcontroller operates. A properly configured shield can read the IOREF pin voltage and select the appropriate power source or enable voltage translators on the outputs to work with the 5V or 3.3V.

Memory

The ATmega328 has 32 KB (with 0.5 KB occupied by the bootloader). It also has 2 KB of SRAM and 1 KB of EEPROM (which can be read and written with the EEPROM library).

Input and Output

See the mapping between Arduino pins and ATmega328P ports. The mapping for the Atmega8, 168, and 328 is identical. Each of the 14 digital pins on the Uno can be used as an input or output, using `pinMode()`, `digitalWrite()`, and `digitalRead()` functions. They operate at 5 volts. Each pin can provide or receive 20 mA as recommended operating condition and has an internal pull-up resistor (disconnected by default) of 20-50k ohm. A maximum of 40mA is the value that must not be exceeded on any I/O pin to avoid permanent damage to the microcontroller.

4.2 LCD DISPLAY

Liquid crystal displays (LCDs) have materials which combine the properties of both liquids and crystals. Rather than having a melting point, they have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an ordered form similar to a crystal.



An LCD consists of two glass panels, with the liquid crystal material sandwiched in between them. The inner surface of the glass plates are coated with transparent electrodes which define the character, symbols or patterns to be displayed. Polymeric layers are present in between the electrodes and the liquid crystal, which makes the liquid crystal molecules to maintain a defined orientation angle.



On each polariser is pasted outside the two glass panels. These polarisers would rotate the light rays passing through them to a definite angle, in a particular direction. When the LCD is in the off state, light rays are rotated by the two polarisers and the liquid crystal, such that the light rays come out of the LCD without any orientation, and hence the LCD appears transparent. When sufficient voltage is applied to the electrodes, the liquid crystal molecules would be aligned in a specific direction.

The light rays passing through the LCD would be rotated by the polarisers, which would result in activating/highlighting the desired characters. The LCD's are lightweight with only a few millimeters thickness. Since the LCD's consume less power, they are compatible with low power electronic circuits, and can be powered for long durations. The LCD's don't generate light and so light is needed to read the display. By using backlighting, reading is possible in the dark. The LCD's have long life and a wide operating temperature range. Changing the display size or the layout size is relatively simple which makes the LCD's more customer friendly. The LCDs used exclusively in watches, calculators and measuring instruments are the simple seven-segment displays, having a limited amount of numeric data. The recent advances in technology have resulted in better legibility, more information displaying capability and a wider temperature range. These have resulted in the LCDs being extensively used in telecommunications and entertainment electronics. The LCDs have even started replacing the cathode ray tubes (CRTs) used for the display of text and graphics, and also in small TV applications.

4.3. ALOCHOL SENSOR

Blood alcohol content (BAC), also called blood alcohol concentration, blood ethanol concentration, or blood alcohol level is most commonly used as a metric of alcohol intoxication for legal or medical purposes. Blood alcohol content is usually expressed as a percentage of alcohol (generally in the sense of ethanol) in the blood. For instance, a BAC of 0.10 means that 0.10% (one tenth of one percent) of a person's blood, by volume (usually, but in some countries by mass), is alcohol. This alcohol sensor is suitable for detecting alcohol concentration on your breath, just like your common breathalyzer. It has a high sensitivity and fast response time. Sensor provides an analog resistive output based on alcohol concentration.

4.3.1. Alcohol Gas Sensor MQ-3 features

- 5V DC or 5V AC
- Requires heater voltage
- Operation Temperature: -10 to 70 degrees C
- Heater consumption: less than 750mW

4.3.2. Dimensions

- 16.8mm diameter
- 9.3 mm height without the pins.



4.4. IR SENSOR

An InfraRed sensor (IR sensor) is an electronic device that measures infrared (IR) light radiating from objects in its field of view. Apparent motion is detected when an infrared source with one temperature, such as a human, passes in front of an infrared source with another temperature, such as a wall. All objects emit what is known as black body radiation. It is usually infrared radiation that is invisible to the human eye but can be detected by electronic devices designed for such a purpose. Infrared transmitter is one type of LED which emits infrared rays generally called as IR Transmitter. Similarly IR Receiver is used to receive the IR rays transmitted by the IR transmitter. One important point is both IR transmitter and receiver should be placed straight line to each other. The transmitted signal is given to IR transmitter whenever the signal is high, the IR transmitter LED is conducting it passes the IR rays to the receiver.

4.5. ENCODER AND DECODER

An encoder is a device, circuit, transducer, software program, algorithm or person that converts information from one format or code to another, for the purposes of standardization, speed, secrecy, security, or saving space by shrinking size.

A decoder is a device which does the reverse of an encoder, undoing the encoding so that the original information can be retrieved. The same method used to encode is usually just reversed in order to decode.

In digital electronics, a decoder can take the form of a multiple-input, multiple-output logic circuit that converts coded inputs into coded outputs, where the input and output codes are different. E.g. n-to-2n, binary-coded decimal decoders. Enable inputs must be on for the decoder to function, otherwise its outputs assume a single "disabled" output code word. Decoding is necessary in applications such as data multiplexing, 7 segment display and memory address decoding.

4.6. RELAY

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. The coil current can be on or off so relays have two switch positions and they are double throw (changeover) switches. Relays allow one circuit to switch a second circuit which can be completely separate from the first.

The coil of a relay passes a relatively large current, typically 30mA for a 12V relay, but it can be as much as 100mA for relays designed to operate from lower voltages. Most ICs (chips) cannot provide this current and a transistor is usually used to amplify the small IC current to the larger value required for the relay coil. The maximum output current for the popular 555 timer IC is 200mA so these devices can supply relay coils directly without amplification.



4.7. SIGNAL CONDITIONING UNIT (SCU)

The signal conditioning unit accepts input signals from the analog sensors and gives a conditioned output of 0-5V DC corresponding to the entire range of each parameter. This unit also accepts the digital sensor inputs and gives outputs in 10 bit binary with a positive logic level of +5V. The calibration voltages* (0, 2.5 and 5V) and the health bits are also generated in this unit. Microcontrollers are widely used for control in power electronics. They provide

real time control by processing analog signals obtained from the system. A suitable isolation interface needs to be designed for interaction between the control circuit and high voltage hardware. A signal conditioning unit which provides necessary interface between a high power grid inverter and a low voltage controller.

4.8. RF TRANSMITTER RECEIVER

Radio frequency (RF) radiation is a subset of electromagnetic radiation with a wavelength of 100km to 1mm, which is a frequency of 3 KHz to 300 GHz,[1] respectively. This range of electromagnetic radiation constitutes the radio spectrum and corresponds to the frequency of alternating current electrical signals used to produce and detect radio waves. RF can refer to electromagnetic oscillations in either electrical circuits or radiation through air and space. Like other subsets of electromagnetic radiation, RF travels at the speed of light.

4.8.1. Radio communication

In order to receive radio signals, for instance from AM/FM radio stations, a radio antenna must be used. However, since the antenna will pick up thousands of radio signals at a time, a radio tuner is necessary to tune in to a particular frequency (or frequency range).[2] This is typically done via a resonator (in its simplest form, a circuit with a capacitor and an inductor). The resonator is configured to resonate at a particular frequency (or frequency band), thus amplifying sine waves at that radio frequency, while ignoring other sine waves. Usually, either the inductor or the capacitor of the resonator is adjustable, allowing the user to change the frequency at which it resonates.

4.9. ALARM

An alarm gives an audible or visual warning about a problem or condition.

4.10. Buzzer

A buzzer or beeper is a signalling device, usually electronic, typically used in automobiles, household appliances such as a microwave oven, or game shows. It most commonly consists of a number of switches or sensors connected to a control unit that determines if and which button was pushed or a preset time has lapsed, and usually illuminates a light on the appropriate button or control panel, and sounds a warning in the form of a continuous or intermittent buzzing or beeping sound. Initially this device was based on an electromechanical system which was identical to an electric bell without the metal gong (which makes the ringing noise).

Often these units were anchored to a wall or ceiling and used the ceiling or wall as a sounding board. Another implementation with some AC-connected devices was to implement a circuit to make the AC current into a noise loud enough to drive a loudspeaker and hook this circuit up to a cheap 8-ohm speaker.

Nowadays, it is more popular to use a ceramic-based piezoelectric sounder like a Sonalert which makes a high-pitched tone. Usually these were hooked up to "driver" circuits which varied the pitch of the sound or pulsed the sound on and off.

5. WORKING PRINCIPLE

5.1. Transformer

The potential transformer will step down the power supply voltage (0-230V) to (0-6V) level. Then the secondary of the potential transformer will be connected to the precision rectifier, which is constructed with the help of op-amp. The advantages of using precision rectifier are it will give peak voltage output as DC, rest of the circuits will give only RMS output.

5.2. Bridge rectifier

When four diodes are connected as shown in figure, the circuit is called as bridge rectifier. The input to the circuit is applied to diagonally opposite corners of the network, and the output is taken from the remaining two corners.

5.3. Reverse Bias

Let us assume that the transformer is working properly and there is a positive potential, at point A and a negative potential at point B. the positive potential at point A will forward bias D1 and reverse D2. At this time D3 and D1 are forward biased and will allow current flow to pass through them; D4 and D2 are reverse biased and will block current flow. The path for current flow is from point B through D1, up through RL, through D3, through the secondary of the transformer back to point B. this path is indicated by the solid arrows. Waveforms (1) and (2) can be observed across D1 and D3. One-half cycle later the polarity across the secondary of the transformer reverse, forward biasing D2 and D4 and reverse biasing D1 and D3. Current flow will now be from point A through D4, up through RL, through D2, through the secondary of T1, and back to point A. This path is indicated by the broken arrows. Waveforms (3) and (4) can be observed across D2 and D4. The current flow through RL is always in the same direction. In flowing through RL this current develops a voltage corresponding to that shown waveform (5). Since current flows through the load (RL) during both half cycles of the applied voltage, this bridge rectifier is a full-wave rectifier.

One advantage of a bridge rectifier over a conventional full-wave rectifier is that with a given transformer the bridge rectifier produces a voltage output that is nearly twice that of the conventional full-wave circuit.

This may be shown by assigning values to some of the components shown in views A and B. assume that the same transformer is used in both circuits. The peak voltage developed between points X and y is 1000 volts in both circuits. In the conventional full-wave circuit shown—in view A, the peak voltage from the center tap to either X or Y is 500 volts. Since only one diode can conduct at any instant, the maximum voltage that can be rectified at any instant is 500 volts.

The maximum voltage that appears across the load resistor is nearly-but never exceeds-500 vOlts, as result of the small voltage drop across the diode. In the bridge rectifier shown in view B, the maximum voltage that can be rectified is the full secondary voltage, which is 1000 volts. Therefore, the peak output voltage across the load

resistor is nearly 1000 volts. With both circuits using the same transformer, the bridge rectifier circuit produces a higher output voltage than the conventional full-wave rectifier circuit.

ADVANTAGES:

1. Less power consumption
2. Small size
3. Accuracy
4. Easy to implement
5. Reliable
6. Efficient

APPLICATIONS:

1. In Airports
2. Buses and any other public vehicles
3. Toll gates
4. Checking in police departments

6. CONCLUSION

The progress in science & technology is a non-stop process. New things and new technology are being invented. As the technology grows day by day, we can imagine about the future in which thing we may occupy every place. The proposed system based on Atmel microcontroller is found to be more compact, user friendly and less complex, which can readily be used in order to perform. Several tedious and repetitive tasks. Though it is designed keeping in mind about the need for industry, it can extended for other purposes such as commercial & research applications. Due to the probability of high technology (Atmel microcontroller) used this” ARDUINO BASED EMBEDDED SYSTEM IN ROAD SAFETY” is fully software controlled with less hardware circuit. The feature makes this system is the base for future systems. The principle of the development of science is that “nothing is impossible”. So we shall look forward to a bright & sophisticated world.

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