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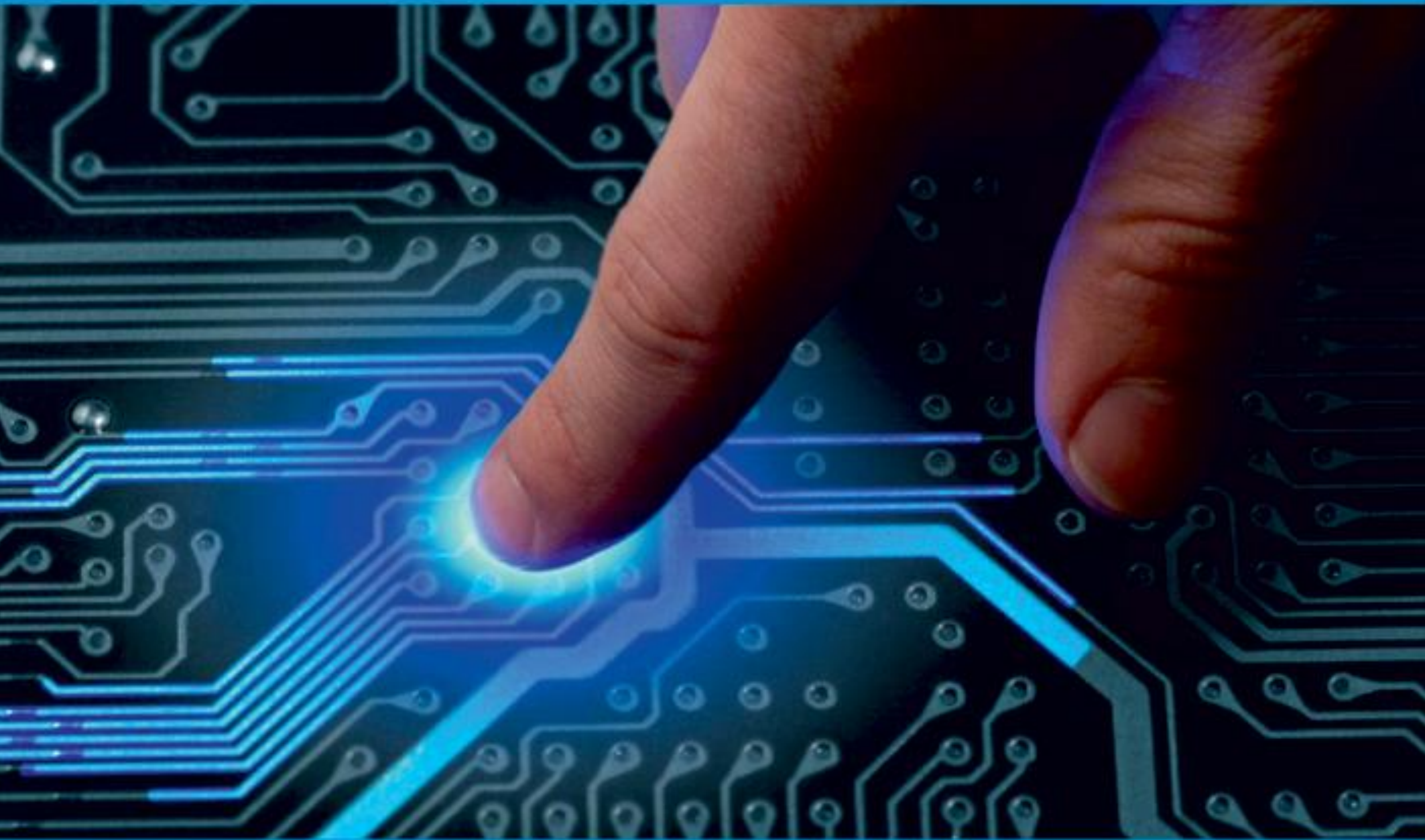

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Object Detection Subsystem Using Sonar to Avoid False Accusation

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ABSTRACT: In forensic pathology, the reconstruction of the dynamic of traffic injuries is still difficult and frequently depends on circumstantial evidence. Camera is a digital image capture which can be in front of a vehicle and capture the image depending on situations, thus providing objective evidence. Here we present the case of a traffic crash in which a pedestrian was hit by a motor bike. The analysis of image captured from a camera located in front of the vehicle during the Death Scene Investigation (DSI) was crucial in the reconstruction of the manner of death. Indeed, the death, which was initially assumed to be accidental, was finally deemed as a suicide based on the image captured, which showed an intentional and sudden rush of the victim to the middle of the roadway. Based on the present case, in traffic crashes, the search for camera footage during the DSI (Death Scene Investigation) may be recommended and for an accurate recollection of the events, the collected image should be examined as part of a multidisciplinary assessment of the case. We all know that accidents can be incredibly stressful, and it's not uncommon for those involved to have differing accounts of what happened. This can lead to false accusations and lengthy legal battles, which can be both time-consuming and costly. To solve this problem, we created a camera system that captures high-definition pictures of mishaps as they occur. This system will avoid the rider from false accusation and provide a solid proof.

KEYWORDS: Traffic Accident, Camera, Footage, High-Definition Pictures,False Accusation.

I.INTRODUCTION

"The safety and wellbeing of the rider comes first and foremost," is said. In today's world, accidents are unfortunately a common occurrence, and it's essential to have a way to document the events accurately. Accidents can occur anywhere, anytime, as we are all too aware, and frequently with little to no notice. We've all heard tales of accidents in which there were no witnesses, forcing investigators to reconstruct what happened solely from physical evidence.

The most urgent issues, such as checking for injuries and, if at all feasible, obtaining the driver's contact information, insurance information, tag number, witness information, and pertinent images, should be given priority right away. Though it might be natural to want to take out your phone and start recording the driver in order to capture more video, keep in mind that doing so could exacerbate an already uncomfortable situation. It can occasionally act as a deterrence to further warfare. Sometimes a hostile or unreasonable driver grows more irritated, which makes the situation worse rather than better.

We all know that accidents can be incredibly stressful, and it's not uncommon for those involved to have differing accounts of what happened. This can lead to false accusations and lengthy legal battles, which can be both time-consuming and costly. To solve this problem, we created a camera system that captures high-definition pictures of mishaps as they occur. Our device may start capturing when an accident occurs and is made to be installed in vehicles. The image is safely archived and can be used as proof to ascertain responsibility and prevent false accusations. Tell the officer who is responding that you have a bike camera and have taken some pictures. You can always show that to the authorities. Most importantly, don’t modify, edit, compress, or otherwise alter the original picture. Making sure that our captured image evidence is preserved is critical. It isn't always as beneficial as we may expect or think in every crash or event, but in our experience, if it is usable, it's been the difference between a conclusion that seems like nothing and one that resembles justice as much and closely as possible.This system will always allow you to have a better understanding about the situation that has occurred and will then help you from false accusation. In matters of places

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where there are no camera and hard proof but rather have some few witnesses who might go against you and provide false evidence. Having your own piece of evidence will avoid you from getting into trouble.

II.SCOPE AND OBJECTIVE

This scope of the project is to provide visual representation of captured pictures for the situation in case of accidental scene. This arranges the captured pictures to avoid false accusation on the person and uses the same as evidence purpose. Even if there is a damage to the system, one may use the memory of the system to view the evidence. One can use this system to find the image evidence of the scene to avoid false accusation.

The number of accidents is gradually increasing day-by-day. People also expect no injuries to happen or no damage to happen for the vehicle or oneself. Even a small city may have accidents to be witnessed; it is a difficult to pronounce as to whose mistake it was. Therefore, our objective is to avoid the false accusation by the accident parties by providing the image captured of the scene. People can view the images any time whenever it is necessary. As a result, person will save himself from false accusation, which will also benefit in the investigation.

III.METHODOLOGY

The main brain of this is Arduino, but to sense the object we must use object detector and distance measuring sensor that is sonar. Below figure1 shows the schematic diagram of Object Detection Subsystem using Sonar. When the object is detected by Ultrasonic sensor, it sends the data into the Arduino.

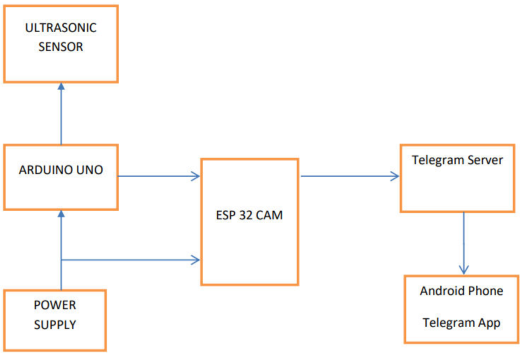

Fig. 1: Schematic diagram for Object Detection Subsystem using Sonar

The Arduino Uno is connected to the Ultrasonic sensor which acts as the object finder in the system and this sensor sends the data into the Arduino .The Arduino intern process these data and activates the ESP 32 CAM to click the picture of the object in front and this object is immediately processed and sent in to the main cloud server that is telegram .This transfers this image into the app of the user and displays is to the user .It also indicate the user when the photo is being clicked. The process keeps repeating when the object is in the sensor range.

IV.SYSTEM DESIGN

4.1: Steps of building the module

Step 1: Object detecting

Step 2: Capturing the image

Step 3: Viewing and storing the image

Step 1: Object detecting

- Below figure 2 shows the reflected waves from the object when sonar detects it.
- The sensor detects the object and sends the data to the Arduino.
- The object is detected based on the certain specified distance. Hence any object in the senor range is detected and the data is sent for processing.

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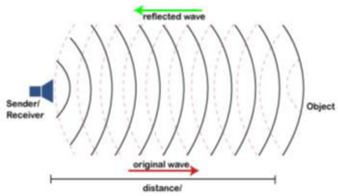

Fig.2: Reflected waves from the sonar

Step 2: Capturing the image

- The data collected from the sensor is sent to Arduino.
- After we test the model we integrate the ESP 32 cam to the model. ESP 32 cam works as the camera module.
- The Arduino intern processes these data and activates the ESP 32 cam to click the picture of the object in front.
- This object data is immediately processed and sent into the main cloud server of telegram.

Step 3: Viewing and storing the image

- Initialize your Telegram bot and obtain the bot token.
- Install the Telegram library for the ESP32-CAM module.
- In your sketch, capture an image using the ESP32-CAM's camera and save it to a variable.
- Use the "sendPhoto" method of the TelegramBot library to send the image to a Telegram chat or channel. This method takes the chat ID, image data, and image size as arguments.

4.2 Flowchart

The below figure 3 depicts the flowchart of the proposed system. Initially we have to start the system and connect to WiFi network, which is required for the ESP to communicate with other devices. And once the ESP has connected to the WiFi network, the program displays the WiFi status in the serial monitor. The program waits for the sonar sensor and the movement to initialize. This step ensures that the program is ready to detect motion before proceeding.

Further on the program checks whether there is any movement in front of the sonar sensor. If there is no motion, the program goes back to the previous step and waits for the sensor to detect movement. If there is motion, the program continues to the next step, that is the ESP32 captures the image when motion is detected in front of the sonar sensor.

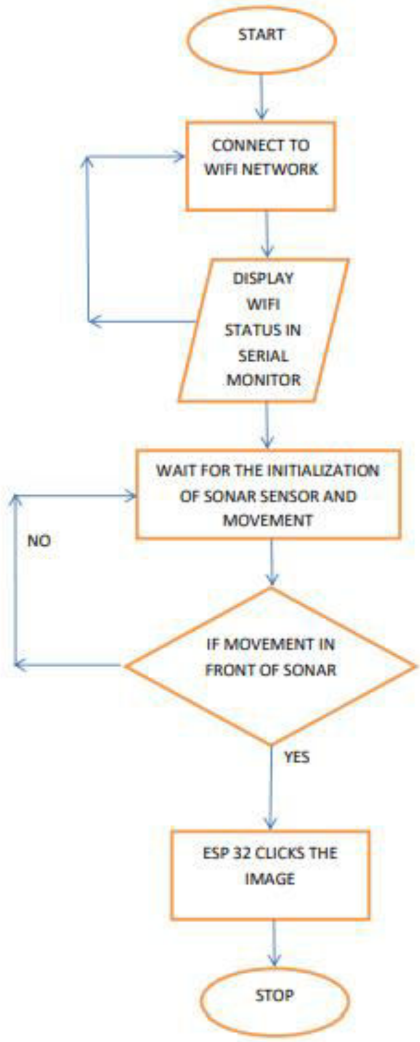

Fig.3: Flowchart for the proposed system

V. SYSTEM IMPLEMENTATION

The sonar sensor is designed in such a way that any object within sensor range is detected. Considering this, the designed prototype detects the object within 30 cm of distance from sonar. Once the object is detected, sonar send the data to the Arduino, and thus Arduino intern sends the signal to esp 32 cam to capture the image. Hence the image is captured. Considering the safety, a simple object or any obstacle can be used to mimic as the source to detect as shown in he below figure 4. Arduino is used to read the data from sonar n send the signal to esp 32 cam.

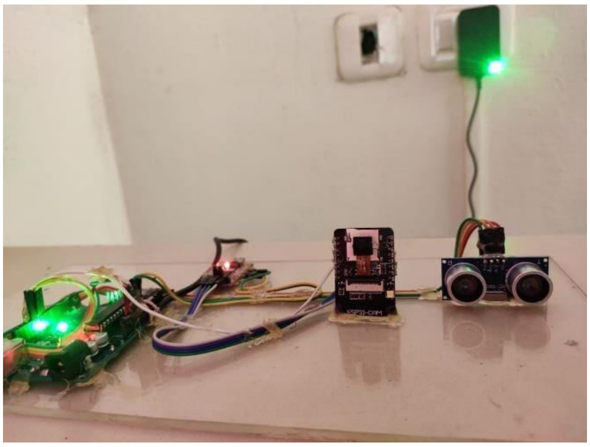

Fig. 4: The working model

Once we have the HC-SR04 connected to the Arduino, we may use a library such as the NewPing library to easily interface with the sensor and read the distance measurements. Here the measuring distance that we have considered is 30 cm, this can be altered according to user convenience.

Ultrasonic Sensor HC-SR04	Arduino
VCC	5V
Trig	Pin 11
Echo	Pin 12
GND	GND

Fig. 5: HC-SR04 and Arduino connection

The above figure 5 shows the HC-SR04 and Arduino connection. Note that the Trig and Echo pins can be connected to any available digital pins on the Arduino. In this, we've used Pin 11 and Pin 12 respectively. Also, make sure to connect the VCC and GND pins to the 5V and GND pins on the Arduino respectively.

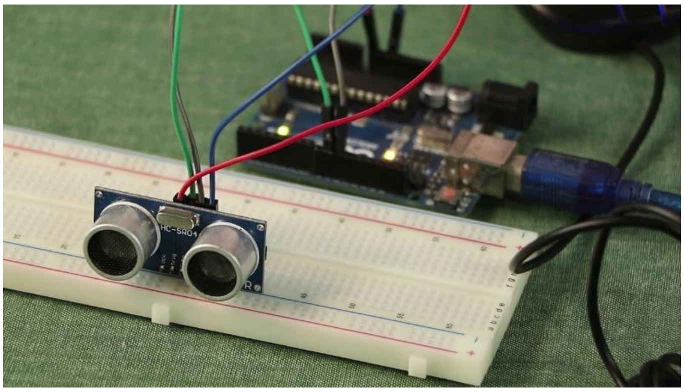

Fig.5: Physical connection of Sonar with Arduino

The above figure 5 shows the physical connection as to how sonar sensor is connected to Arduino to detect the object in the surrounding.

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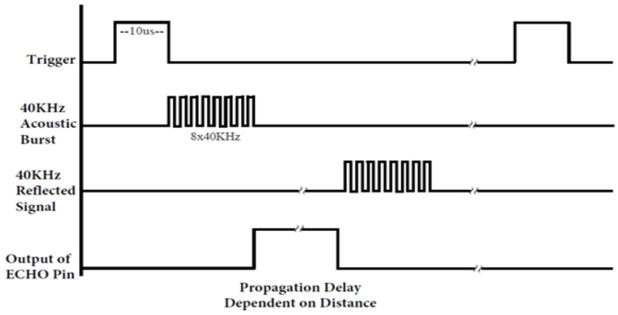

Fig. 6: Ultrasonic sensor timing diagram

The above figure 6 shows the timing diagram of HC-SR-04.

How to examine the timing diagram:

1. The trigger pulse must be delivered to the Trig pin for at least 10 microseconds.

2. After that, the gadget automatically sends eight pulses at a frequency of 40 kHz as it watches for the output pin's rising edge.

3. Once the echo pin has detected a rising edge, start the timer and monitor how long it takes for a falling edge to appear.

4. Keep an eye on the timer count and look for a lowering edge on the echo pin. The time taken for the sensor to identify an object and return from it is shown by the timer's countdown.

As we know that

D = S * T

D = Distance

S = Speed

T = Time

The formula for calculating the distance is: (343*Time at HIGH ECHO)/2.

The number "343" in the formula above denotes the sound speed in the air medium when taken into account at room temperature.

Since the sound wave goes from the source to the item and then returns to the source, the total distance is divided by 2.

Noise is present in the ultrasonic sensor's measured result. In most cases, the device's loud output results in unneeded functionality and displays mistakes as well. The following method can be used to filter the noise out of the output.

1. Try with multiple calculations (consider 2 trails) and sort the result in an array.
2. Sort the stored array in ascending format.
3. Filter the noise levels (the smallest and biggest 5 samples are termed to be noise and we can ignore those)
4. Observe the average value of middle sample from 5th trial to 14th trial.

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Serial pins for Arduino: There is at least one serial pin available on each Arduino board. TX and RX pins are the names of the pins. RX stands for receiving, and TX is for transmitting. One TX pin and one RX pin are provided on the Arduino Uno board. Serial pins are used on digital pins 0 and 1. Three more serial pins are present on the Arduino Mega. Therefore, the Arduino Mega has access to four serial connection pins.

ESP32 Serial Pins: TX and RX pins are also included on ESP32 boards. There could be more or fewer serial pins, depending on the model. For serial transmission, we can utilise any of the ESP32's UARTs, however the UART0's default settings are as follows. The TX0 and RX0 pins on the ESP32 should be connected to the relevant RX and TX pins on the USB-to-serial converter. In order to complete the circuit, be sure to connect the GND pins as well.

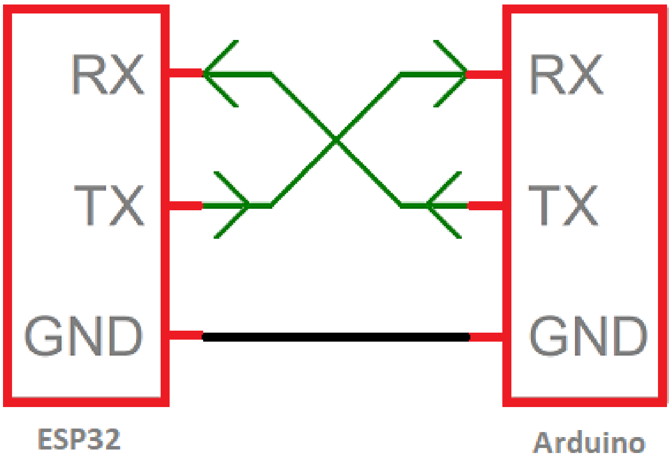

Fig. 7: Communication between Arduino and ESP32

Communication between Arduino and ESP32 is shown in the above figure 7. And the below figure shows the Exchange Data between Arduino and ESP32 using Serial Communication.

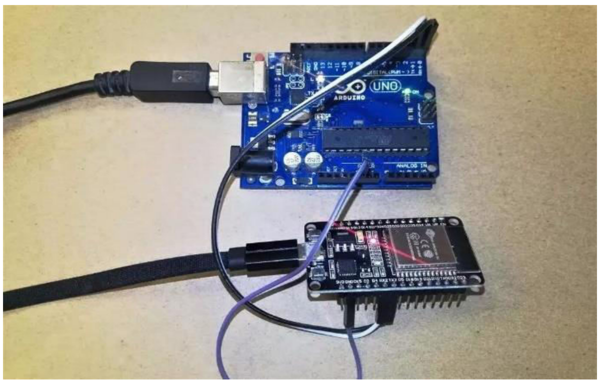

Fig. 8: Exchange Data between Arduino and ESP32 using Serial Communication

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5.2 Circuit Diagram

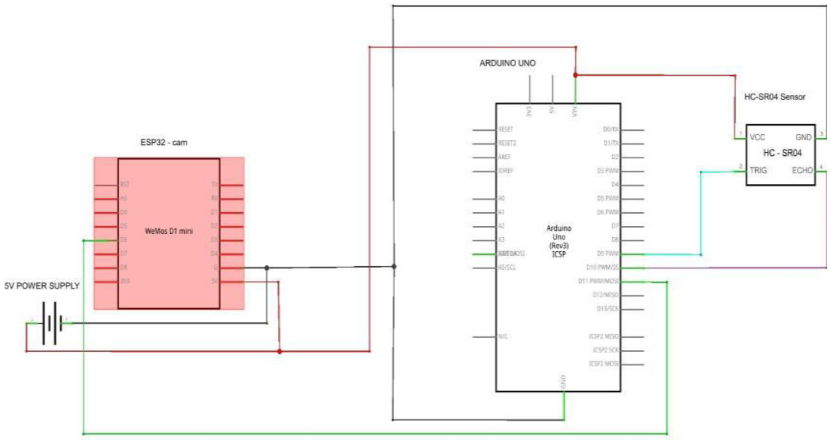

Fig.9: Circuit Diagram of Esp32, Arduino and Sonar module.

The above figure 9 depicts the circuit diagram of the designed prototype which mainly consists of ESP 32 CAM as it works as a camera and as the Internet based data communicator to the telegram bot server and the hardware in the prototype. The Arduino Uno is connected to the Ultrasonic sensor which acts as the object finder in the system and this sensor sends the data into the Arduino. GND of esp32 cam and sonar module are connected to GND of Arduino. The VCC of Esp32 and sonar is connected to the 5V power supply. Pin D11 acts as a trigger pin to trigger Esp32 cam module when sonar detects any object within its range.

VI.RESULT AND DISCUSSION

The prototype is capable of detecting the object and capturing images successfully. The Arduino code and other component work together to detect and capture the image of obstacles. It can sense, detect and capture the image of the object in range of the sensor, leading to capture the evidence which is enough to save oneself from false accusations. The system was able to connect to a Wi-Fi network, display Wi-Fi status in the serial monitor, and wait for the initialization of the sonar sensor and movement. When movement was detected in front of the sonar, the ESP32 captured an image and stopped, thus enabling the accurate identification of objects in the vicinity. The prototype is designed for the vehicles, where it can be mounted on the front side of the vehicle to capture the incoming obstacles. The prototype shown in the figure 10 is designed for the outdoor application.

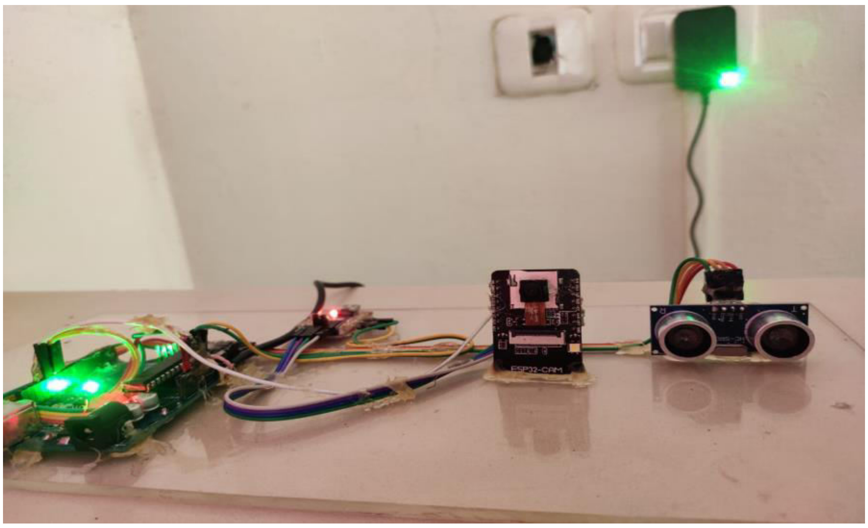

Fig. 10: Prototype

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VII.CONCLUSION

The design was successfully implemented and can provide evidence to avoid false accusations.By leveraging the capabilities of the ESP32 microcontroller, we were able to develop a reliable and accurate system that detected objects in its vicinity using sonar and avoided false accusations.

Further we made use of 5 Volt 2 Amp Power Adapter for the purpose of power supply. This prototype can detect any object within its range and further boot ESP32 module to capture the image and send into the bot server of telegram for purpose of saving the image. This image can then later be used for providing with evidence. Overall, this project provides a solid foundation for the development of surveillance systems that are more accurate and reliable, thus avoiding false accusations and improving public safety.

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