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Automatic Vehicle Safety and Driver Assistance

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Abstract – With the intention of speeding up emergency response times and sparing lives, accident detection and notification systems are technological solutions created to automatically detect and report accidents. Sensors, microcontrollers, communication modules, and software are frequently used in the system, which cooperate to identify environmental changes that might be signs of an accident. These modifications may take the form of abrupt deceleration, swift direction changes, or the discovery of impact. The systems send an alert to emergency services when an accident is discovered, including the accident's location and any other pertinent information. Numerous communication channels, including SMS, email, and push notifications, are available for this alert's distribution. The main goal of this system is to deliver quicker emergency response times, which could ultimately result in more lives bring saved.

Keywords – Raspberry Pi, Pi Camera, Speaker.

I. INTRODUCTION

A system for detecting accidents or collisions and automatically alerting relevant parties, such as emergency services, medical services, and/or family members, is known as an accident detection and notification system. These systems make use of a number of technologies, including sensors, cameras, and GPS to identify accidents and notify those involved.

The main goal of such a system is to speed up emergency services' response times and improve the chances of accident victims' survival. The system, which can be installed in cars or on roads, can detect accidents and immediately alert emergency services.

In a system that is mounted on a vehicle, sensors that measure the force of impact are used to identify collisions. The system can also use cameras to record images or videos of the collision, which can be helpful in pinpointing the accident's cause and identifying those responsible.
To detect accidents and alert emergency services, sensors can be installed along the roadways in a roadway-based system. The system can also use GPS to locate the accident and notify nearby hospitals or medical services of its location.

The WHO estimates that 1.35 million people died as a result of traffic accidents worldwide in 2018. A reliable and universal accident detection and notification system that can be installed in any type of motor vehicle is urgently needed to lower the number of fatal accident incidents. Such a system will aid Emergency Centers in accelerating their medical services by sending accident notifications instantly. As a result, the overall casualty rate in road accidents can be decreased and the deaths in road accidents caused by delays in emergency services can be avoided.

Through the Bluetooth connection that has been established between the Bluetooth of the Accident Detection System (ADS) and the Raspberry Pi, the Accident Detection System (ADS) in the system detects the accident, accident severity, and side of impact and transmits this data to the Raspberry Pi. This causes the Raspberry Pi-connected audio and video modules to start gathering audio and video data from the accident scene.

II. LITERATURE SURVEY

In paper by A. Chaudhari [1], The substantial loss of lives, property, and time caused by street crashes is a major public health concern. Many lives can be saved if medical assistance is provided quickly. The system described in this paper alerts the user's emergency contacts when a mishap occurs by sending a message that includes the location of the detected event. The car's sensor quickly recognises when there is an accident and sends an SMS to the emergency contacts. When everyone inside the car is safe, a reset button can be used to stop the alarm from going out to the crisis contacts.

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In paper by N. Kattukkaran [2], These days, there are a lot more accidents on the roads, especially involving two wheels. Quick medical intervention can help save lives. This system aims to notify the nearby medical facility of the accident and deliver prompt medical assistance. The heartbeat sensor on the user's body detects an abnormal heartbeat and the attached accelerometer in the vehicle detects the vehicle's tilt to determine how serious the accident was. As a result, the systems will decide and transmit the data via Bluetooth to the smartphone that is connected to the accelerometer and heartbeat sensor. The Android app on the phone will text friends and the closest hospital with emergency information. The application also discloses the precise location of the collision, which can help save time.

In paper by A. Bhakat [3], In this essay, an IoT application that could potentially save thousands of lives is examined and suggested. For precise road accident identification, we have combined IoT with machine learning techniques and image processing. Data from sensors such as an accelerometer, gyroscope, camera, etc. is provided to a microprocessor, which compares the sensor data with the machine learning model to determine whether an accident has occurred or not. If one has, the device then sends the pertinent metrics to the server over the internet.
Here, we've adopted Edge computing to replace the use of a centralised server topology, allowing us to handle requests more quickly close to home. Response time is further improved by this. When the data reaches an edge server, it uses the GPS data to identify the closest hospitals and police stations and notifies them as well as the user-registered phone number once those locations have been identified. It transforms into a life-saving technology in this way.

In paper by R. K. Kodali [4], There is usually a news story about a car accident when we open the newspaper these days. The average number of cars on the road has increased dramatically around the world as cars become more and more affordable. Accidental losses of time and money cause devastation for victims. Following in-depth research, it has been determined that the majority of accidents result in fatalities due to poor communication with the relevant medical authorities and the ensuing dearth of prompt medical assistance.

III. BLOCK DIAGRAM AND WORKING OF THE SYSTEM

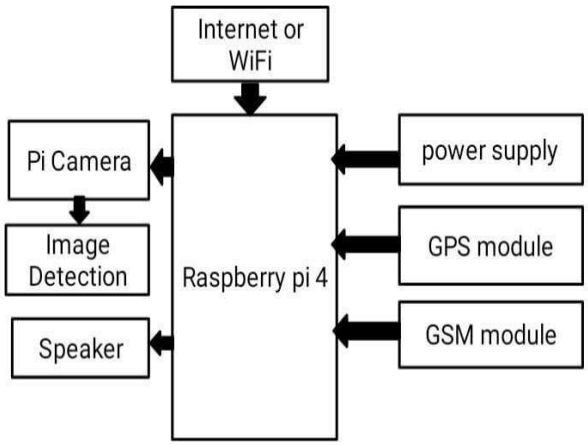

Fig 1. Block Diagram of the accident detection and notification system

It graphically explains the structure of the entire system, as seen in Fig. 1. The Raspberry Pi Foundation created the dual-display Raspberry Pi 4 single-board computer. The 1.5 GHz quad-core processor that this device has is strong and effective, and is regarded as its brain. This module is offered with RAM capacities of 1 GB, 2 GB, 4 GB, and 8 GB. One of the three USB ports on the Raspberry Pi 4 lines is a USB-C power port that is used to power the module. This application helps with better coordination, keeps all relevant authorities and bodies informed, and alerts them quickly, which also cuts down on the amount of time it takes to rescue an accident victim. Usually, a person involved in an accident is not in a position to interact with a phone app and request assistance. Accidents in these circumstances are automatically detected in the user app based on sound reading and sensor reading. Constantly detecting such accidents is the user app. A person is typically unable to interact with an application on his phone to request assistance when they are in an accident. Accidents in these circumstances are automatically detected in the user app based on sound reading and sensor reading. The user app constantly scans for these accidents. Accident is automatically detected in the user app based on sound

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reading and sensor reading, and the user app continuously senses for such accidents. It will be made clear to those who need to know about this incident right away so that they can take immediate action.

IV. ALGORITM FOR ADS SYSTEM

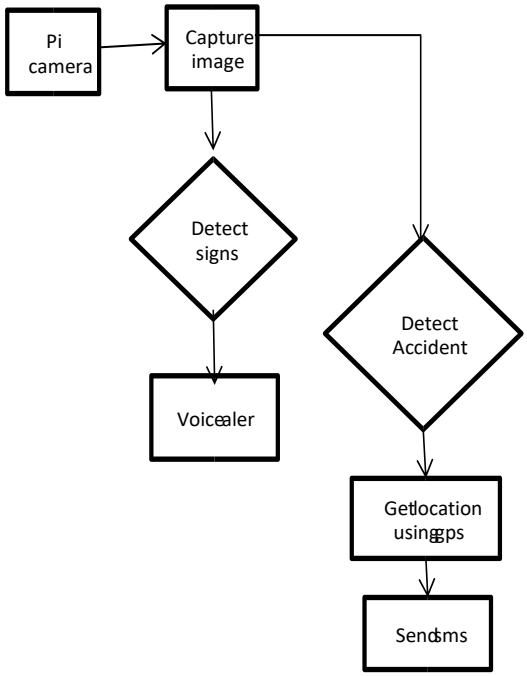

Fig 2. Algorithm for ADS system

The algorithm for the ADS system is depicted in Fig. 2. The signs boards that are found along the side of the road are identified by the Pi camera, and the output is audible through a voice alert. It is considered an impact and an accident is said to have happened if the overall acceleration in the driving and side directions is greater than 1.5 g. On a slick surface, it's possible that the two-wheeler will fall without experiencing a significant 1.5g deceleration. Therefore, fall detection during a typical ride is included in the accident detection algorithm for two-wheelers. But the simple fall of the two-wheeler while it is not in motion does not signify an intense accident. It can produce a false alarm. As a result, fall detection should only be activated while the two-wheeler is moving. The intensity of the impact is the only factor that differentiates two-wheeler detection from that of other vehicles. Because passengers will have the support of the back seat, the severity of rear impacts may not actually be that severe. As a result, there is less risk of injuries. As a result, both frontal and side crashes have their accident severity determined. The direction (positive or negative) of the acceleration along the y-axis can be used to determine whether the exact side of impact was on the right or left.

V. COMPONENTS USED FOR HARDWARE

1. Raspberry pi:

The Raspberry Pi 4B is the fourth generation of the Raspberry Pi series of single-board computers. It was released in June 2019 and is the successor to the Raspberry Pi 3B+. Here are some key features of the Raspberry Pi 4B:

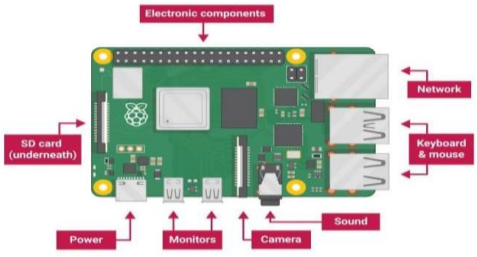

Fig 3. Raspberry pi

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- Broadcom BCM2711, quad-core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz
- 2GB, 4GB, or 8GB LPDDR4-3200 SDRAM (depending on model)
- Gigabit Ethernet
- 2 USB 3.0 ports and 2 USB 2.0 ports
- 2 micro-HDMI ports (up to 4Kp60 supported)
- 2-lane MIPI DSI display port
- 2-lane MIPI CSI camera port
- 4-pole stereo audio and composite video port
- H.265 (4Kp60 decode); H.264 (1080p60 decode, 1080p30 encode); OpenGL ES 3.0 graphics
- 5V DC via USB-C connector (minimum 3A), or via GPIO header (minimum 3A)
- Operating temperature: 0 – 50 degrees C ambient

The Raspberry Pi 4B is a popular choice for hobbyists, educators, and professionals due to its low cost, small form factor, and flexibility. It can be used for a wide variety of projects, including media centers, home automation, robotics, and more.

2. Pi Camera

The Pi Camera, also known as the Raspberry Pi Camera Module, is a small camera accessory designed for use with the Raspberry Pi single-board computer. It can capture high-quality still images and video footage, making it ideal for a range of applications, including security cameras, drones, and robot projects.

Fig 4. Pi Camera

There are several versions of the Pi Camera available, including the original 5-megapixel camera module, the 8-megapixel camera module, and the high-definition (HD) 12-megapixel camera module. The camera modules connect to the Raspberry Pi via a ribbon cable and can be controlled using the Raspberry Pi's camera software.
The Pi Camera has become popular among hobbyists and professionals alike due to its ease of use, low cost, and versatility. It can be used for a wide range of projects, including time-lapse photography, wildlife monitoring, and even home automation.

3. Memory Card

A memory card is a small, portable electronic device used to store digital data. It is commonly used in electronic devices such as cameras, smartphones, and tablets, to provide additional storage space for photos, videos, music, and other files.

Memory cards come in various shapes and sizes, and there are different types of memory cards available, such as Secure Digital (SD), CompactFlash (CF), Memory Stick (MS), and microSD. Each type of memory card has its own specifications, such as storage capacity, data transfer speed, and durability.

Memory cards are widely used because of their small size, portability, and convenience. They allow users to easily transfer data between devices, and they are also relatively inexpensive compared to other forms of data storage.

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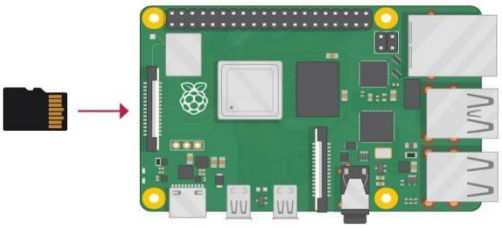

Fig 5. Memory Card

When choosing a memory card, it is important to consider factors such as the storage capacity, speed, compatibility with your device, and the intended use. It is also recommended to purchase memory cards from reputable brands to ensure their reliability and longevity.

4. Monitor

Connecting a monitor to a Raspberry Pi is a simple process. The Raspberry Pi has a standard HDMI port, which allows it to connect to most modern monitors or TVs with an HDMI input.

To connect a monitor to a Raspberry Pi, you will need an HDMI cable that is compatible with your monitor or TV. The Raspberry Pi supports different resolutions, so it's important to check the monitor's recommended resolution and configure the Raspberry Pi accordingly.

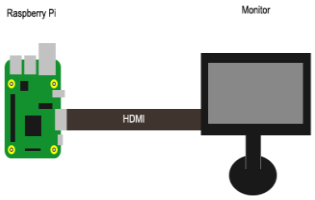

Fig 6. Monitor

To set up the monitor, follow these steps:

1. Connect one end of the HDMI cable to the Raspberry Pi's HDMI port and the other end to the monitor's HDMI input port.
2. Power on the monitor and Raspberry Pi.
3. The Raspberry Pi will automatically detect the monitor and configure the resolution to match the monitor's specifications.
4. If the resolution is not set correctly, you can manually change the settings by going to the Raspberry Pi's desktop environment, selecting "Preferences," then "Screen Configuration," and adjusting the resolution to match the monitor's specifications.

Once the monitor is connected, you can use the Raspberry Pi as you would any other computer, and the display will be shown on the monitor.

5. HDMI to VGA converter

If you want to connect a VGA monitor to a Raspberry Pi that only has an HDMI output, you will need an HDMI to VGA converter.

Here are the steps to connect a VGA monitor to a Raspberry Pi using an HDMI to VGA converter:

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Fig 7. HDMI to VGA converter

1. Connect one end of the HDMI cable to the Raspberry Pi's HDMI port and the other end to the HDMI input port on the HDMI to VGA converter.
2. Connect one end of the VGA cable to the VGA output port on the HDMI to VGA converter and the other end to the VGA input port on the monitor.
3. Power on the monitor and Raspberry Pi.
4. The Raspberry Pi will automatically detect the HDMI to VGA converter and configure the output to match the monitor's specifications.
5. If the resolution is not set correctly, you can manually change the settings by going to the Raspberry Pi's desktop environment, selecting "Preferences," then "Screen Configuration," and adjusting the resolution to match the monitor's specifications.

It is important to note that HDMI to VGA converters may introduce some signal degradation, so the image quality may not be as sharp as when using a digital connection. Also, some converters may require additional power, which can be supplied via a USB port on the Raspberry Pi.

6. Speakers

Connecting speakers to a Raspberry Pi is a simple process, and there are several ways to do it. Here are the steps to connect speakers to a Raspberry Pi:

1. Identify the audio output port on the Raspberry Pi. Most Raspberry Pis have a 3.5mm audio jack or an HDMI audio output port. If your Raspberry Pi does not have a built-in audio output, you can use a USB audio adapter to add one.

2. Connect the speakers to the audio output port. If you are using a 3.5mm audio jack, connect one end of the audio cable to the audio jack on the Raspberry Pi and the other end to the audio input on the speakers. If you are using an HDMI audio output port, connect an HDMI cable from the Raspberry Pi to a compatible monitor or TV with built-in speakers.

3. Configure the audio settings on the Raspberry Pi. By default, the audio should work without any additional configuration. However, you may need to adjust the audio settings if you are not getting any sound or if the sound

Fig 8. Speakers

quality is poor. You can do this by going to the Raspberry Pi's desktop environment, selecting "Preferences," then "Audio Device Settings." From there, you can select the audio output device and adjust the volume.

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4. Play audio on the Raspberry Pi. Once you have connected the speakers and configured the audio settings, you can play audio on the Raspberry Pi. You can use a media player application such as VLC or Kodi, or you can play audio directly from the command line using the "aplay" command.

VI. RESULTS

The proposed system uses the IoT for vehicle accident detection and alarming the authorities regarding accidents, vehicle tracking and sends the notification. As soon as an accident has happened the raspberry pi camera module will detect and accident sends an immediate notification to registered mobile numbers, police station and also to the hospital, it will also alert the nearby vehicles by beeping sound through the speaker.

VII. CONCLUSION

It is imperative that an accident be discovered as soon as possible so that the person involved can be saved. Due to the fact that many accidents occur on highways, the traditional method of notifying the emergency authorities of an accident has always been for someone else to call the emergency helplines after seeing the accident. The process of receiving the required assistance is made much more effective by the system that includes the automatic notification system. Additionally, information provided to emergency authorities regarding the accident's severity and the direction of the vehicle's impact can be very useful in determining the priority of receiving medical attention.

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