



TWO WHEELER CRASH DETECTION DEVICE

Shardul Jeurkar, Karan Borkar, Anay Choube, Prof. Umesh Raut, Yash Govardhan
B.Tech, Computer Science
MIT WPU, Pune
Pune, Maharashtra

Abstract—This paper introduces to a modern solution for two wheeler vehicular crash detection by using Tilt sensor to determine the crash & sim 8001 module to determine location & broadcast message. This device can not only detect crash using the Tilt sensor, but can also broadcast the location of the device along with an emergency message. The device is fully automated. The respective programs will be on an raspberry pi and will be executed on start-up. If there is a hit and run case, the user can check the device for evidence recorded using the USB camera module. SSH is used as an interface between the device and the User. The device will detect all crashes when equipped and would continue monitoring the two wheeler vehicle. This paper deals with the control of a Raspberry Pi based device which will monitor two wheeler vehicles according to the program and push out location as well as an emergency message when crash is detected.

Keywords—Raspberry Pi, Tilt Sensor, Sim8001, USB Camera Module, SSH

I. INTRODUCTION

Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation in association with Broadcom. The Raspberry Pi project originally leaned towards the promotion of teaching basic computer science in schools and in developing countries. The original model became more popular than anticipated, selling outside its target market for uses such as robotics. It is widely used in many areas, such as for weather monitoring, because of its low cost, modularity, and open design. It is typically used by computer and electronic hobbyists, due to its adoption of HDMI and USB devices.

In countries like India, two-wheelers have become more popular in the absence of public transport, the number of road accidents involving these is also growing. More than a third (37%) of those killed in road accidents in 2019 were two-wheeler riders, noted a Ministry of Road Transport and

Highways' report published in October this year. More crashes and deaths are resulting from faulty licensing laws, no training, poor roads and unsafe helmets. India needs stricter licensing laws and must ensure use of proper helmets through effective communication and fines, experts told India Spend. As the gross national income per capita rises, the number of two-wheelers also increases; an exponential growth in a country's two-wheeler fleet might result in a rapid increase in the number of motorcycle crashes. Due to all of these reasons, a need for an IOT based device such as Raspberry Pi or Raspberry Pi is felt to lower the no. of accidents in any way possible...

The main brain of this device is Raspberry Pi 3b. Raspberry Pi is a series of small single-board computers which makes use of a System On Chip (SoC). With the use of on-board serial ports to interface various modules, we can utilize their individual features to tackle this problem.

In our device we have used Raspberry Pi as our microcontroller, which will be controlled by Python Programs. Initially, the device has to be connected to a power source via a micro-usb port, then, as the pi gets powered, the subsequent modules also receive power. The device has 1 sensors & 2 modules, i.e., Tilt sensor, Sim8001 & camera module. Tilt sensor is used to detect crash based upon the tilt made to the device w.r.t. (with respect to) X and Y axis. This is one of the most prominent feature of this device, i.e., it will detect the crash while the vehicle is displacing and will continue to monitor unless an anomaly is detected. This feature is very significant when dealing with accidents, as it can detect any mishaps that take place (Crash, Hit & Run, etc), and can handle the post-processing. Another fabulous feature of this device are the emergency broadcast messages. This is achieved by using the sim8001 module which gives us the benefits of using a sim, such as internet & sending messages. This device also has the ability to capture short video bursts and store them in the in-built SD device. This small and compact robot can be quite handy when dealing with accidents. To understand the concept refer to figure 1.

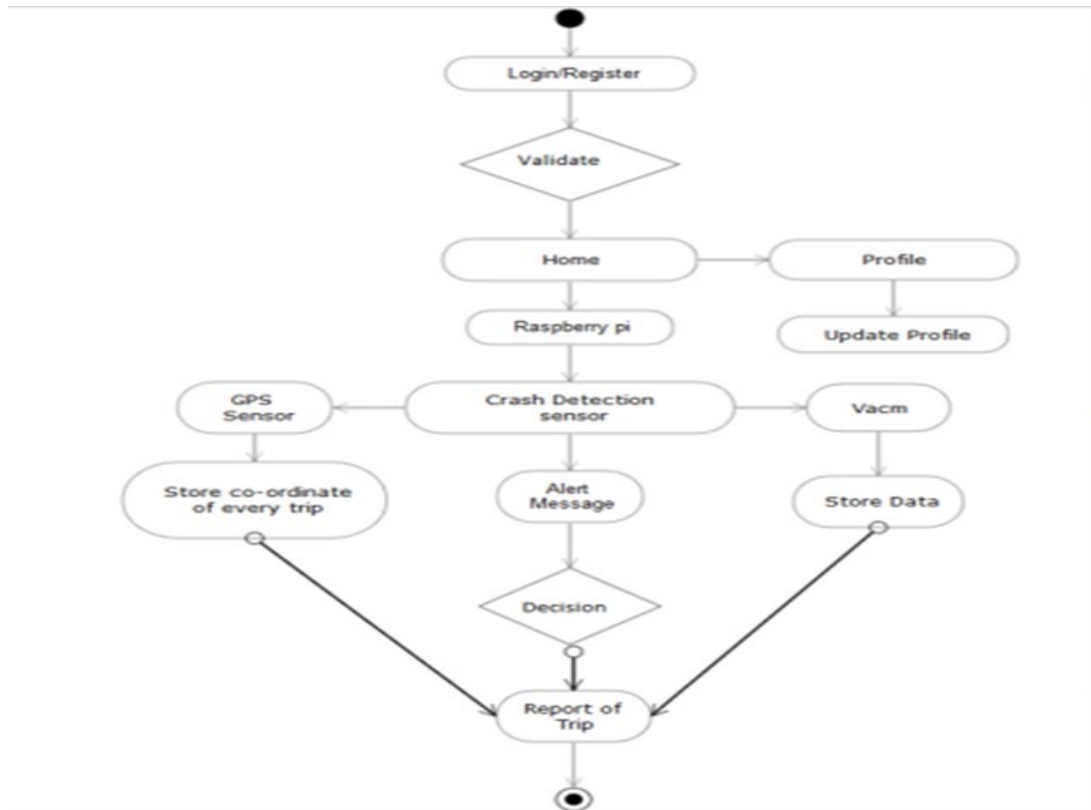


Figure 1: Module Description

II. PROPOSED SYSTEM

This iot based device can be equipped in geared as well as in non-geared vehicles to lower the amount of human

casualties. The proposed system for this device can be seen in the figure 2.

It consists of 4 main components. 1) The Programs, 2) Crash Detection, 3) EMS (Emergency Message System) & 4) Video Capturing

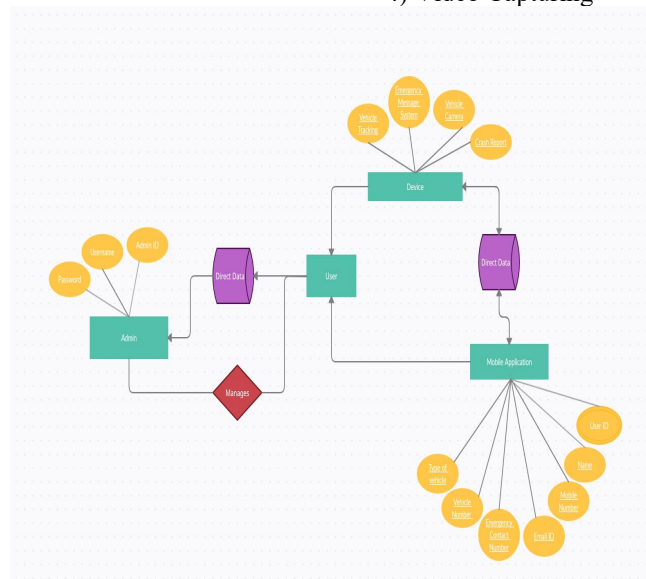


Figure 2: Proposed system



A. Programs

The whole device is controlled by this module. The device has to be mounted to the desired two-wheeler vehicle & provided with power using a power bank. After the power has been provided successfully, Raspberry Pi will start up and start executing the individual programs. Once the programs start executing, the Raspberry Pi will start generating & monitoring vital data such as the current tilt, location & storage available. Each respective function of the device is instructed by the programs. Refer to figure 3 for use case diagram

B. Video camera

This module enables the user to collect important video data in case of a hit & run scenario. It helps the user with providing the evidence if such an occurrence takes place. The camera can also be used to record your trips from the vehicles POV. The video will be stored on the device itself. All this data is stored on the SD card of the raspberry pi

C. Crash Detection

The crash detection module deals with the device's ability to detect a crash/accident. The crash irrespective of being of a lower impact or quite substantial, will be registered as a

mishap. The device will automatically detect crashes through the use of Tilt sensor. Sensors play an important role in this module.

III. METHODOLOGY

Once the device is mounted & connected to a power source via Power Bank, the user has to check if the green led on the Pi is blinking. After performing this check, the entire further process is automated. On startup, the raspberry pi starts executing the respective individual programs for the modules. The features of crash detection, location gathering and video feed will always be in working. All the video feeds will be stored on the SD card. If the user wishes, he/she can check the video feed later. The user can also increase the storage capacity as well as the powerbank capacity.

IV. SYSTEM DESIGNING

The designing structure and the body of the device is very simple and easy. The system comes as package with a tilt sensor that is attached to the perpendicular rod connecting the handle to the front wheel which will be deciding factor to determine an accident

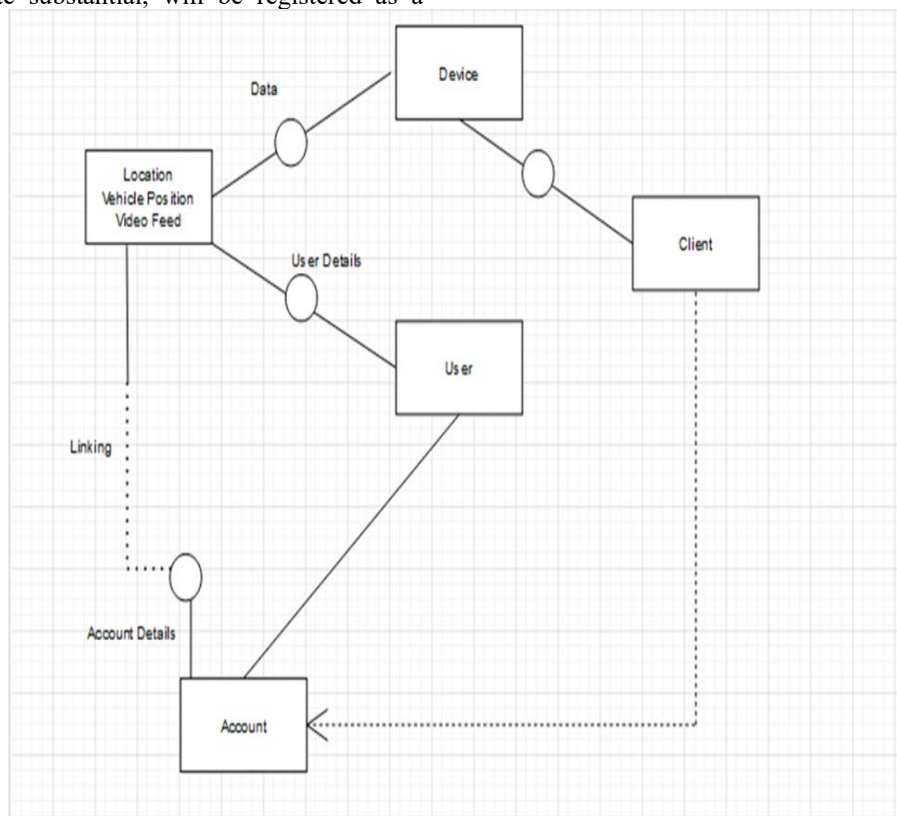


Figure 4: Component diagram

V. HARDWARE

The hardware device is made up of the following components:

A. Raspberry Pi 3b

Raspberry Pi is the main brain of the device system. It controls all the sub-modules and provides functionality to the entire device. It is running the Raspbian OS. All its programs for this project are written directly on terminal (bash commands) or using Python(Thorny IDE). It works like a CPU where-in all the modules can perform functions like computing & processing on the device itself & perform actions as directed by the programs.

B. Camera

Quantum QHM495LM 6 is a light weight decent camera that is capable of capturing 30 fps videos with a 16 MP camera with a focus range of 4 cm to infinity, originally designed to be used as a webcam its attractive features such as switch based LED lights and small form factor make it ideal for usage in this project

C. Sim800l module

The SIM800L is a cheap and portable GSM breakout board with all the capabilities of the larger SIM900 shields. Its features include, 2G quad-band<1900 Mhz, receiving and making calls, receiving and sending SMS, connecting to internet, etc.

It is used to broadcast message with location data from Raspberry Pi to emergency contacts. It's also used to connect Pi to the internet.

D. Tilt sensor

Tilt sensors are devices that produce an electrical signal that varies with an angular movement. These sensors are used to measure slope and tilt within a limited range of motion.

Tilt sensor is used in this project to detect crashes. It calculates the angles or tilts in simple language w.r.t. the previously calibrated device position and sends the signals accordingly to Raspberry Pi.

VI. FUTURE SCOPE

The future scope for this project includes providing a more better and reliable power source. Since we are using a powerbank, the power backup is limited. The user might've to swap out the powerbank after exhausting its battery which may pose as a threat to the user for that time period.

VII. SOFTWARE

Raspbian is used as the Host OS.

To implement the functionality of the device and to write the programs for Raspberry Pi, Bash Commands/Python is used.

VIII. CONCLUSION

In this research paper, we have presented the design and implementation of a Crash Detection Device using Raspberry Pi, Tilt Sensor, GPS Module, and Sim 800L. The primary objective of this device was to address the critical issue of delayed response time in road accidents by providing real-time crash detection and notification capabilities.

Through the integration of various components and sensors, our Crash Detection Device offers a reliable and cost-effective solution for detecting accidents. The Tilt Sensor accurately detects sudden changes in the vehicle's orientation, enabling the identification of potential crashes. The GPS Module enables real-time tracking of the vehicle's location, facilitating prompt assistance to accident sites. The Sim 800L module allows for the seamless transmission of SMS notifications to emergency contacts or relevant authorities, providing them with crucial information about the crash location.

The Crash Detection Device offers several advantages over traditional crash detection methods. Its low-cost implementation, leveraging the Raspberry Pi platform, makes it accessible and affordable for a wide range of users. Furthermore, the device's ability to log crash data over time enables post-accident analysis, aiding in the identification of accident patterns and potential areas for improved safety measures.

The results of our research indicate that the Crash Detection Device achieved high accuracy in detecting crashes, minimizing false positives and false negatives. Field tests and simulations demonstrated its effectiveness in real-world scenarios, providing timely notifications to emergency contacts and relevant authorities.

Future enhancements to the Crash Detection Device can involve integrating additional sensors and technologies to further improve accuracy and reliability. Incorporating machine learning algorithms for crash detection and advanced data analytics techniques for comprehensive accident analysis could also be explored.

In conclusion, the Crash Detection Device using Raspberry Pi, Tilt Sensor, GPS Module, and Sim 800L demonstrates the potential to significantly enhance road safety by reducing response times in the event of accidents. This device has the capacity to save lives, minimize injuries, and improve emergency response systems. As advancements continue, it is our hope that this technology will become more widely adopted, contributing to a safer and more secure transportation ecosystem.

IX. REFERENCES

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