Smart Helmet for Accident Detection and Navigation

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Abstract : Many researches in the past have been done on wearable devices which provide user a smart system for tracking human actions and also taking preventive measures in emergency conditions. Smart Helmet's made before used seven segment display for generating notifications and grey scale was used for tracking rare view. This paper motivates the use of advanced technologies available today like Raspberry pi, camera module, led display and vibration sensors. GPS technology is used for generating location report when vibration sensor for reporting an accidental impact. This report is sent from rider's cell phone to emergency services and his/her family members. The head mounted led screen displays the rear view and also provides navigation support to the rider. Using this helmet, a rider achieves an obstruction free ride and is also be facilitated with smart features.

I. INTRODUCTION

The likelihood of injury is extremely high in motorcycle accidents: 97% of the vehicle accidents resulted in some kind of injury to the motorcycle rider; 45% resulted in more than a minor injury. The most deadly injuries to the accident victims are injuries to the chest and head. The use of the safety helmet is the single most critical factor in the prevention of reduction of head injury. Helmeted riders have fewer neck injuries than un-helmeted riders. Helmets are estimated to be 37-percent effective in preventing fatal injuries to motorcycle riders. Government has taken several steps for road safety, one of such includes compulsion for wearing helmet. The police and the district administrations in India, have been conducting a series of awareness programs on the advantages of helmet. Under such conditions providing a smart helmet to the rider could help to serve the cause. The helmet along with safety should provide several advanced features to the user to increase rider's interest in wearing a helmet. Hence the motive of this paper is to provide the idea about Smart Helmet which is safe and secure for the user and consists of certain smart features.
Smart helmet in this paper consist of rear view display and navigation support on a head mounted display attached to the helmet. It will also generate location report for an emergency system under which various emergency services and rider's family is informed about the accident. By this, user will be provided with safety and also with the measures which will be undertaken under emergency conditions.

Raspberry Pi: The Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry pi foundation to promote the teaching of basic computer science in schools and in developing countries. It consists of various ports for connecting peripherals like led display, camera module, sensors, etc. We have installed Android Things operating system on Raspberry Pi to get basic Android functionalities like Google maps, nearby API, camera API, etc.

Vibration sensor: Vibration sensor is used to detect impact on helmet in case of accident. Vibration sensor SW-420 can be used with Raspberry Pi. By sensing strong vibrations we can detect that if the user is in emergency situation or not. The input from sensor can be converted using ICMPC3008 and can be given to the raspberry pi and then ACK is sent to user's application using nearby API. As soon as the ACK is received messages are sent to the registered phones numbers which are stored in the settings of application.

Camera Module: A camera on the rear side of the helmet is installed to fetch the view behind riders back, the same will be displayed on led display. On the raspberry pi 3 version dedicated camera port is provided. Using this port we can connect camera to the raspberry pi module. Using specific commands we can either take pictures, record videos, live feed to a display from camera. Camera can be integrated in the Raspberry Pi using camera2 API on Android things platform.

Mounted Display: Similar to the camera port a display port is also provided. Using this dedicated displays such as LCD, touch screen displays can be connected. This can be used to display user interface or specific task such as footage from camera. Navigation is also displayed on the mounted display, this will reduce user's obstruction while riding.
We have installed Android THINGS operating system on raspberry for installation of application supporting multiple modes like navigation and rear view. With the above components we provide the rider with a smart helmet. The camera module installed on the rear side will be connected with the led screen, because of this the user will be aware of the rear

environment and the vehicles behind his back. This will eliminate the user's effort to adjust himself for getting rear view from the side mirrors of his bike thereby proving a obstruction free ride. Navigation support is also be displayed on the led screen for user convenience.

In case of emergency like accidental situations, the vibration sensor will detect the impact and a location report of rider is generated if the impact reaches certain threshold. This report is forwarded to the emergency services and rider's family. This will serve as precaution post-accident and can also save lives.

The overall smart helmet will provide safety and obstruction free ride to the rider and will also take precautionary measures in case of severe accidental condition. The motive is to reduce the accidents caused due to obstructions faced by rider while riding and making a smart helmet which attract user's interest for wearing helmet while riding.

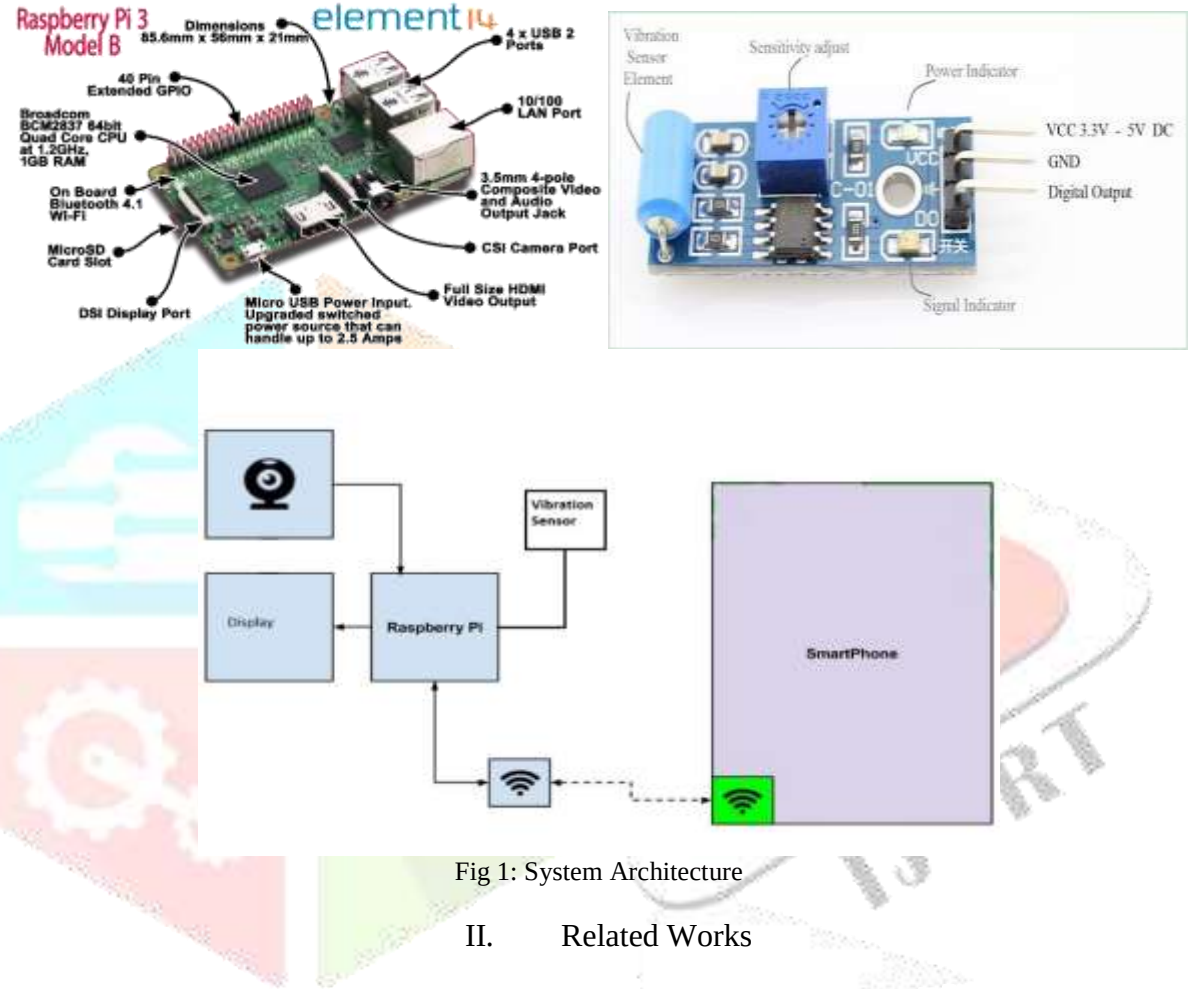

Fig 1: System Architecture

II. Related Works

In today's world, we face number of accidents. These have a severe affect if the rider has no protection like helmet. So we can make a helmet which is smart as well as keeps the rider safe from accidents and also takes necessary steps in case the accident occurs. Smart helmet is a hardware based system consisting of Raspberry Pi 3, camera module, display module and a vibration sensor. The objective of this project is to provide a helmet which has a navigation support and rear view display on a head mounted led screen. The helmet will also provide an emergency SOS which would trigger emergency messages to the family of driver, police station and nearby hospital in case of severe emergency.

Today wearing a helmet has been made compulsory, so the purpose is to motivate any rider for wearing a helmet, by providing him the above described functionalities. The motive of the project is to reduce the accidents caused in today's life as well as dealing with severe accidents. By wearing this smart helmet, the rider gets smart functionalities as well as the same helps him in any emergency case. Led display will be on the right corner side of a helmet such that the rider gets a parallel view of provided functionalities. Camera is attached to the rear side of the helmet, which displays the back view of the rider, this would save him from looking at the side mirrors there by reducing his obstruction while driving. Navigation support is given on the same display thereby restricting the user to operate his cell while riding.

III. Proposed Method

Proposed system would consist of a head mounted led screen, which shows the rear view of the rider. Proposed system consists of navigation support which provides user a precise location of his standings as well as his desired destination

and the route enclosing both. This is done by generating Location from user's phone and sent to Raspberry Pi application for every location change using Nearby API, this location is updated in the MapBox used in Raspberry Pi application for showing route to user. Proposed system will send emergency alert as well as his destination details to the rider's family, hospital and police station using the impact sensed by the vibration sensor. Once impact is sensed, the ACK is sent to users phone using Nearby API, the ACK is used to generate the emergency message and then sent. The Nearby API and MAPBOX API are discussed as follows. Android THINGS operationg system

A. Nearby API

Nearby Connections enables advertising and discovery of nearby devices, as well as high-bandwidth low-latency encrypted data transfers between these devices in a fully-offline `P2P` manner. It achieves this by using a combination of classic Bluetooth, BLE, and Wi-Fi hotspots. It leverages the strengths of each while supplementing their respective weaknesses. For instance, Bluetooth has low connection latency but also provides low bandwidth Wi-Fi hotspots have slightly higher connection latency, but also provide much higher bandwidth. So what it does is connect over Bluetooth and start transferring data instantly but in the background, it also brings up a Wi-Fi hotspot and when that's ready, it seamlessly transfers your connection from Bluetooth to Wi-Fi with absolutely no work required by the app developer.

B. MapBox

MapBox is a large provider of custom online maps for websites and applications such as Foursquare, Lonely Planet, Evernote, the Financial Times, The Weather Channel and Snapchat. Since 2010, it has rapidly expanded the niche of custom maps, as a response to the limited choice offered by map providers such as Google Maps. Mapbox is the creator of, or a significant contributor to some open source mapping libraries and applications, including the MBTiles specification, the TileMill cartography IDE, the Leaflet JavaScript library, and the Carto CSS map styling language and parser. The data are taken both from open data sources, such as Open Street Map and NASA, and from proprietary data sources, such as Digital Globe. The technology is based on Node.js Couch DB, Mapnik, GDAL, and Leafletjs. Mapbox uses data from tracks of its clients' users, such as Strava and Run Keeper, to identify likely missing data in Open Street Map with automatic methods, then manually applies the fixes or reports the issue to OSM contributors.

IV. Experimental Result

V.

Fig 2. Complete Hardware Setup

Fig 3. Operating System Booting Process

Fig 4. GUI for SMART HELMET application.

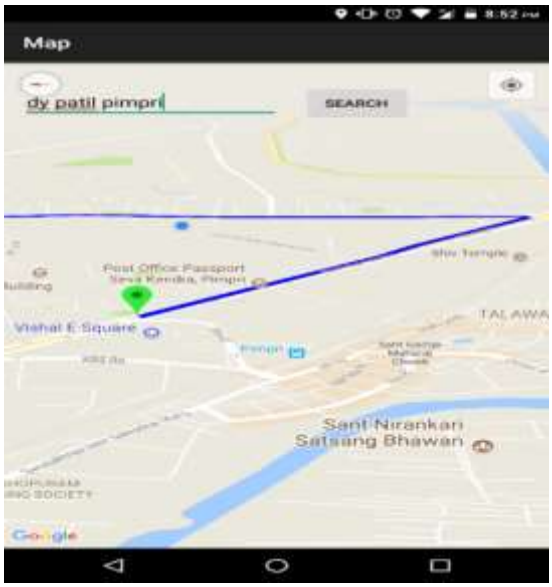

Fig 4. On Select Navigation - Output

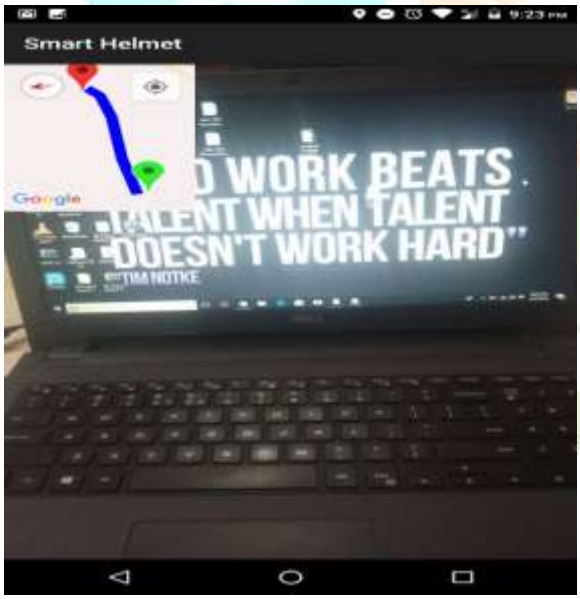

Fig 5. On Select Custom View – Output

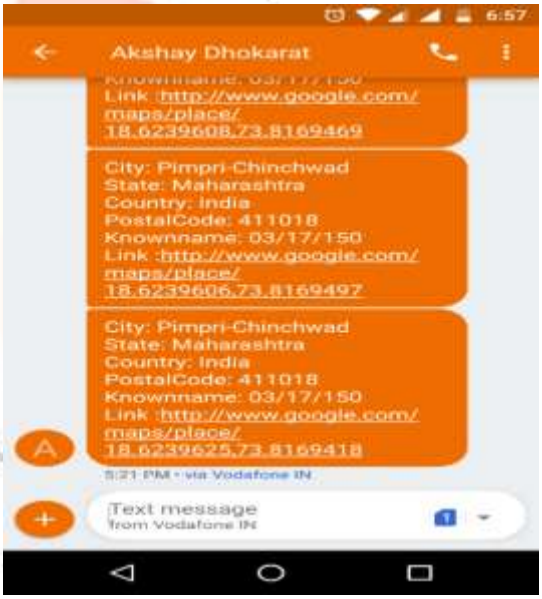

Fig 6. Location Sent on Accident Detection.

VI. Future Scope

1. Rather than using a display the footage can be displayed on the visor.
2. Using a light detection system (ambient sensor) colour of the visor can be changed.
3. Many more functionality can be added such and voice commands.

VII. Conclusion

Today in day to day life we see numerous road accidents. Without proper action at proper time, danger awaits us with a bigger face. We must act on time when a person is injured. We must take care of person the way it is meant. Otherwise, a valuable life might be lost .We need to understand how precious lives of people are and what importance first-aid carries in saving these precious lives. Using this helmet we can make sure that the rider's attention is more on driving

rather than adjusting side mirrors or adjusting himself to look in the side mirrors to get a rear view. Navigation too is seen at a parallel screen for which he need not operate his cell phone. For dealing with case of unexpected accident the system would trigger emergency message to family and emergency services thereby reducing the severe conditions where the ambulances don't reach at time and riders lose their life.

VIII. References

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