Digital Health System in vehicles with Artificial Intelligence Configuration

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Abstract— After long advancement in human health detection, the need of being alerted about health while seating in a vehicle in real time is paramount to everyone. Cardiac diagnosis in two wheelers and cars for riders and drivers using carotid nerve with heart rate sensing device is aimed at acquiring and analysing the data. The advent of Internet of Things have transcend the communication in real time. In this paper, we conduct feasibility of communication of heart diagnosis in real time with Internet of Things paradigm and detection scenario of the real time images using tenser flow of machine learning and data privacy aspects.

Index Terms - Health Monitoring; communication; visualization; IOT; Tensor Flow and architecture of device connectivity in vehicle.

1. INTRODUCTION

The evolution of cardiac diagnosis devices has shown potential in increasing connectivity of heart diagnosis with Internet of Things. Increase in safety of people during an accident by using sensor with Artificial Intelligence in vehicles is no longer just talk. Low cost architecture of health system compatible with cars and bikes for providing diagnostic data with current scenario of incident place in real time has shown potential in in rescuing life from dangers.

Adoption of Digital Health system in the vehicles with Artificial Intelligence configuration will advance the health care in real time with the applied architecture to the helmets of the two wheelers with camera mounted in front of the helmet and cars driving seat with camera mounted in front of driving seat. In this paper, we investigate the placing of the heart rate monitoring sensor and featuring Artificial Intelligence automation to the camera understanding human needs at right time when actually needed. Issues related to communication of sensor data and real time alerting to the concerned person, health departments and police station for rescuing purpose, which will not require manual operation. The architecture of placing sensors to neck rest fitted with helmet and placing of sensors to light weight spring near the neck position with respect driving seat which will be attached to the neck of the driver during the hitting or jerking of the car that can be elongated according to the body flexibility. Here attaching of the spring sensors automatically to the neck will be elaborated in section. Our concluding section remarks in section outline our position in regarding the future of D-health system with Artificial Intelligence configuration in vehicles.

Here, the Section I contains the introduction of the proposed model, section II contains the information of the architecture of the model for the vehicles, section III contains the methodology of sensors and hardware used and section IV is the conclusion of the proposed architecture with reference in the future work.

2. DIGITAL HEALTH SYSTEM ARCHITECTURE FOR VEHICLE

A conceptualized Architecture for two wheelers and cars are depicted in Fig. 2.1 and 2.2, which consists of two sections: Front End section which basically responsible for furnishing comfortable or compact setup for vehicles focusing on the helmet designs by providing neck rest with inbuilt sensors. Also providing spring with sensors to the driver seat below the head rest so that it can come with the contact with the neck which helps in aggregating, and pre-processing the data.

Back End section is responsible for processing the data to extract useful information to detect the person's health conditions. We will now detail the components and challenges of this architecture.

2.1 Design of helmet with sensor integrated neck rest

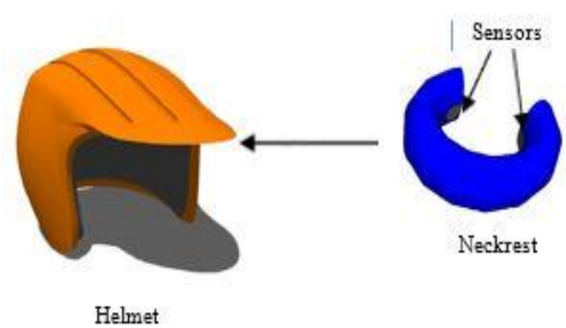

Fig. 2.1, Helmet integrated sensors

In this, helmet is provided with neck rest, which not only provide comfortness to the neck but also integrated with heart rate sensors that provide real time measurements. An additional feature i.e. mounted camera on the helmet will give real time images of the incident place. It is also connected with the mobile hotspot of the rider's mobile, which enables the G.S.M. (Global) for acquiring the data of the heart rate and alerts the concerned person, health departments and police stations during an accident to rescue them from danger.

2.2 Design for emergency responsive driver seat

A driver seat built responsive by providing a design i.e. in the shape of earmuffs for the neck, which is enabled with the heart rate sensor and is connected to the piezoelectric sensor of the vehicle. This piezoelectric sensor will first sense the occurrence of an accident and give its output to the microcontroller. Whenever there is a hard jerk or hitting of vehicle, it automatically bring the proposed spring to the contact of driver's neck. With this, a front camera is mounted on car's dashboard that will provide the real time images with the help of tenser flow automation. This helps in capturing and alerting the real time images and enables the G.S.M. (Global) that is operated with car's Wi-Fi for acquiring the data of the heart rate and alerts the concerned person, health departments and police stations during an accident to rescue people from danger.

Fig. 2.2, Responsive seat with neck connector

3. METHODOLOGY

3.1 BLOCK DIAGRAM AND WORKING PRINCIPLE

In the Figure 3.1, the integration of the sensors, display, GSM and camera with the microcontroller that complete the setup for the working of the helmet for the two wheelers and drivers seat connectivity with the device and the real world. Here are the information of the sensors and hardware mechanism used are:

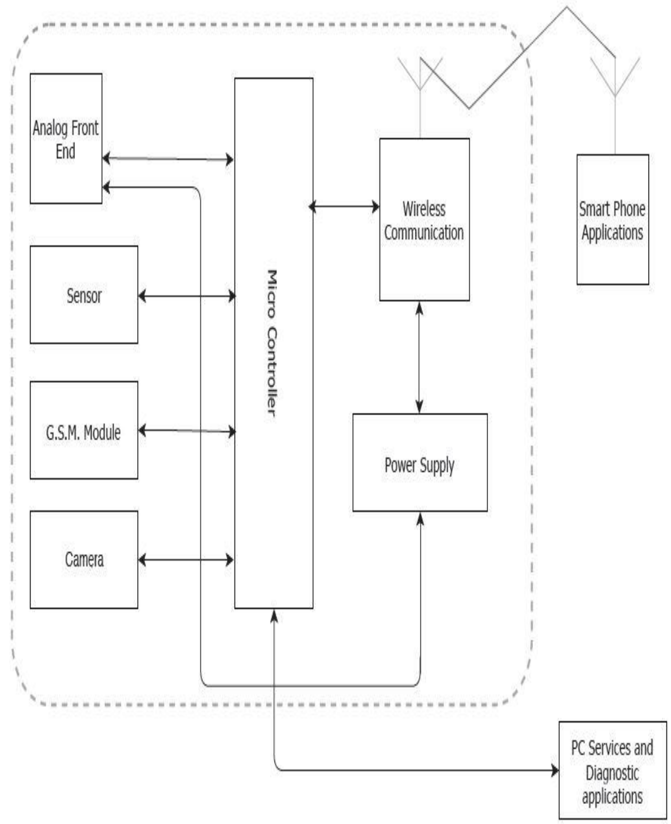

Fig 3.1 Architecture of Health system

3.1.1 Sensors

Heart beat sensor:

- AD8232 adopts an op-amplifier that uses a three pole low pass filter (LPF) and eliminates extra Artifacts/noises.
- Operating temperature range is -40 to 85degree
- The sensor uses the principle of photo plethysmography.
- It measures the change in the volume of blood.

Piezoelectric sensor:

A piezoelectric sensor is used as real time accident detection sensor. In this piezoelectric transducer act as a response for the drivers seat to eject the sensors which is attached to the earmuff like structure that comes in contact with the neck of the driver. Here, due to high DC output impedance which can be modeled as a proportional voltage source and filter network. In this the source voltage is directly proportional to the applied force, pressure, or strain. Now, the mechanical force is related to the output signal which is passed through the equivalent circuit and enables the whole process of ejection of the device.

3.1.2 Communication

GSM:

The Global System for Mobile communications is a 2G or mobiles. The GSM is for the transfer and receiving the voice and data transmission. The first GSM technology was established in the year 1982 in Europe. This was developed by using digital network. It carries 64kbps to 120Mbps. It provides the data roaming service also. Digital mobile communication system was developed by European Telecommunication Standards Institute. The first wireless services were through GSM technology which is popularly called General Packet Radio Service (GPRS). The end users are the first to take the option of Short Message System (SMS). There are four types of GSM networks namely macro, micro, pico and femto cells. Micro and macro cells are provides for outdoor coverage. Pico and femto cells provides for indoor coverage. There are some features of GSM discussed here.

- It gives improved spectrum efficiency.
- It provides international roaming.
- The cost of the mobile is less.
- Speech quality is high.
- GSM supports new services

GSM has ample of functional units. GSM is combination subsystems. The GSM broadly divided as,

- Mobile Base Station (MS)
- Base Station Of Subsystem (BSS)
- Network Switching Subsystem (NSS)
- Operation Support Subsystem (OSS)
- GSM has additional components namely databases and messaging system.

The architecture of GSM is given below:

In the Figure 3.2, we can see some blocks. These blocks comprise of databases and messaging system functions.To know clearly about the architecture abbreviations are given.

- Home Location Register (HLR)
- Visitor Location Register (VLR)
- Equipment Identity Register (EIR)
- Authentication Center (AuC)
- SMS Serving Center (SMS SC)
- Gateway Mobile Station Center (GMSC)
- Chargeback Center (CBC)
- Transcoder And Adaptation Unit (TRAU)

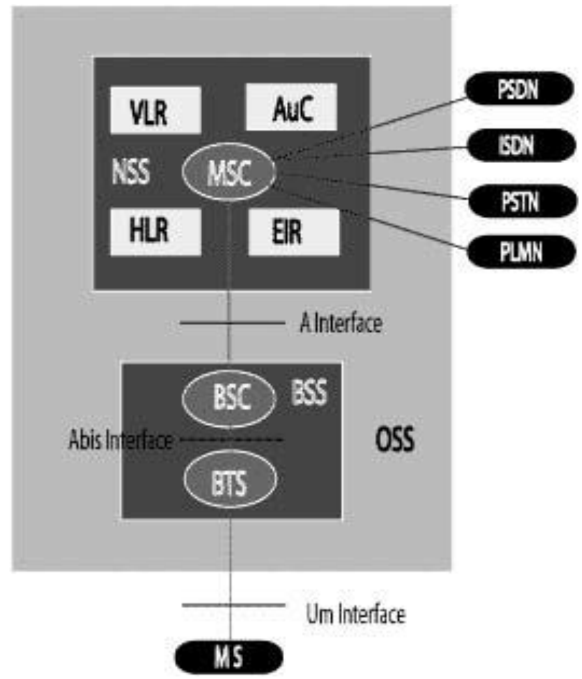

Fig.3.2. GSM architecture

GPS:

GPS time transfer receiver is actually a kind of integrated system which is consisted of receiving engine and relative hardware and software. It is briefly used in GPS common/allview time transferring technology. The constitution of GPS time transfer receiver that based on EURP-160 GPS engine is shown in Fig.3.4, EURP-160 engine and TIC counting card are integrated together in the receiver, the engine and counter are in control of a SCM and transfer data with computer by the bus.

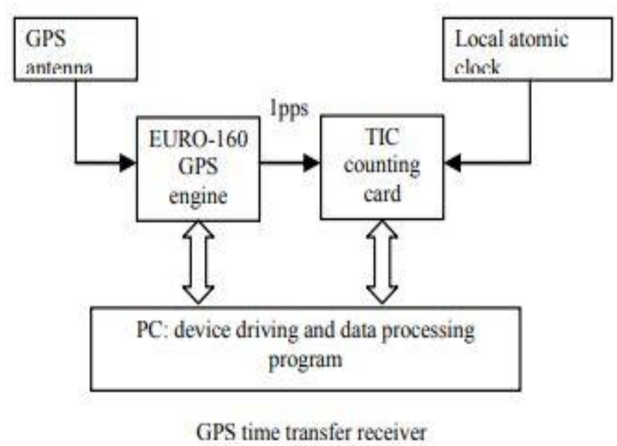

Fig.3.3. GPS time transfer receiver

The 1pps（pulse per second） signal from receiver output is accepted as the open-gate pulse by the counting card, and 1pps signal from the local atomic clock output is accepted as the close-gate impulse, the difference between the two 1pps is measured as the time interval.

Wi-Fi:

Wi-Fi or wireless fidelity is a technology for radio wireless local area networking of devices based on the IEEE 802.11 standards. There are some features of WIFI discussed here:

- 1MB Flash Memory.
- Integrated TCP/IP protocol stack.
- Input voltage range 1.75 to 3.6v.
- Distance range 479 meters.

Antenna:

As shown in Fig. 3.5, Antenna of wireless network interface controller Gigabyte GC-WB867D-I.

- Uses 802.11b or 802.11g access point compliant.
- Range of 100 m (0.062 mi).
- Higher gain rating (dBi)
- ranges can be improved using high gain directional antennas.

Fig.3.4 .Antenna of wireless network interface controller Gigabyte GC-WB867D-I.

3.2.2 Hardware

LCD:

In below given Fig. 3.6, LCD or liquid crystal display is a technology used for displays in laptops, PCs and other smaller computers. LCDs displays are much thinner than cathode ray tube (CRT) technology. An LCD is build with either a passive or an active matrix display lattice. This active matrix LCD is known as a thin film transistor (TFT) display. The passive matrix LCD has a lattice of conductors with pixels situated at each junction in the lattice. Below are the following features discussed :

- It is operated on one resolution called as native resolution.
- Digital-only, analog-only and hybrid of both is available.
- contrast ratio of 400:1

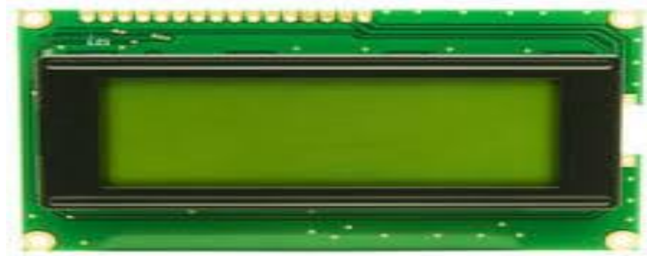

Fig.3.5. LCD display

3.2 Artificial intelligence configuration to camera

3.2.1 Raspberry Pi Camera Board

Raspberry Pi model was nominated as the microcontroller which synchronized all the functions for the portable monitoring system. To ensure efficient power management the monitoring system is designed such that the camera automatically frame the scenes whenever a severe jerk occurs or any high speed movement detected. Therefore, two passive infrared motion sensors were used and inserted to the Input/Output (I/O) pins of the Raspberry Pie board. As shown in Fig. 3.7, WiFi adapter and a GSM modem were connected using the Universal Serial Bus (USB) ports of the RP. The former was used for internet connection through a WiFi router and the later was employed for Short Messaging Service (SMS) alert notification. Since all these components can be powered up at 5V DC battery, also a backup can be provided with the help of power bank as the main power supply.

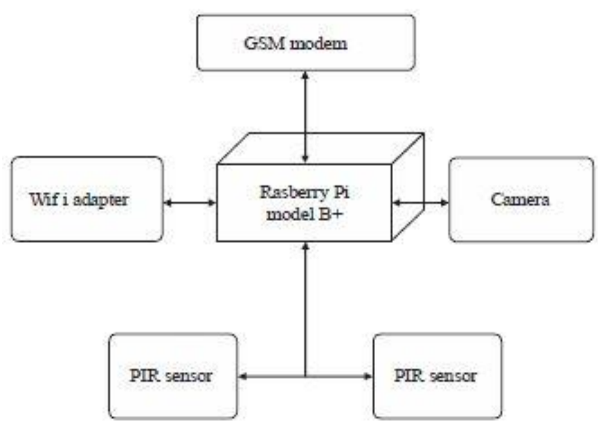

Fig.3.6, Portable Monitoring System

3.2.3 Tenserflow configuration to camera

To compose the program we utilize Python and Tensorflow. Tensorflow is an open source deep learning structure that builds up the granular control of designers on each neuron(known as a "node" in tensorflow). So you can change the weight and accomplish the most ideal execution. The TensorFlow has many worked in libraries (some of which we use for image classification) and a superb group, so you can discover open source usage for any deep learning content. Computers can deal with calculations in numbers and cannot characterize images as we do. To comprehend the computers we have to change over images to numbers in any case.we consider following 5 features for feature extraction i. RGB-The colors can be represented by RGB values (going from 0 to 255, with red, green and blue). computer would then be able to extract the RGB estimation of every pixel and put the outcome in an array for interpretation.At the point when the framework translated another image, it changes a range into the image utilizing a similar strategy, at that point looks at the examples of numbers against objects that it definitely knows. The framework at that point offers certainty scores for every class. The class with the most astounding certainty score is generally the anticipated one ii. Grayscale- The image is changed over to grayscale (white shading to the dim shades of dark) the computer assigns value in view of how dark every pixel is. Every one of the numbers are put into a cluster and the computer does calculations on that exhibit. iii. ZCA/PCA-Principle component analysis it helps to fetch relevant data,tries to change over information to as meager as could be allowed, so each row must be more like each other with basic basis functions (images with one active pixel). Furthermore, it is conceivable to accomplish, in light of the fact that the correlation in characteristic images are relatively neighborhood (so de-correlation channels can likewise be nearby). iv. EDGE-The image can essentially diminish the measure of information expected to process the edge detection calculation and thus filter information that can be considered less relevant, and additionally safeguarding the key basic attributes of the image. Edge detection is one of the necessary steps in image preparing,analysis,model recognition, and computer vision techniques. v. HOGP1-The quantity of pixels in f(with powers [0,L-1]) is a discrete capacity h(rk) = nk ,Where rk is the kth intensity value and nk is the quantity of pixels in f with intensity rk.The general routine with regards to normalizing the histogram is to partition the segments through the aggregate pixels in the picture and accept the MxN picture, which yields p (rk) = nk K = 0,1,2,...,L-1 – p(rk) The likelihood of event of intensity level RK in/mn, essentially, Σ p (rk) = 1 for L-1 - p (rk),in HOG p1.It is Straightforward, budgetary tool usage for histogram Image enhancements,Image statistics, Image compression,Image segmentation and computing software that are a prevalent tool for ongoing image processing.Keras used to bind tensorflow runtime with numpy array which are multidimensional. It manages the input image batches then transformed image batches and finding the image with the respective class.By using keras library it uses sequential and functional model Keras is capable of running on a high level neural system site API and Tensorflow written in Python. It has been created to empower quick trial. It is important to have good research if possible to get out of the imagination to cause at least possible delays. Keras Runs flawlessly on CPU and GPUs.CONV2D is used, example of CONVD2 is spatial convolution over images. This layer makes a convolution kernel, which is refined with layer input that produces items tensor. In the event that Use_bias is True, an incomplete vector is added to the structure and items. At long last, if there is no actuation, it applies to items. When utilizing this layer as the primary layer in the example, the catchphrase contention is input_shape (tuple of numbers, does exclude the sample axis) e.g. data_format = input_shape = (32,3,3) for 32x32 RGB pictures in data_format: "channels_last",and we consider i. kernel_size- An integer or tuple / list of 2 integers, indicates the width and stature of the 2D convolution window. It can be a integer number to indicate a similar value for every single spatial dimensions.ii. Padding- "valid" or "identical" (caseinsensitive). iii. data_format- a string, channels_last (default) or channels_first one. The dimensions of the dimensions in the input will correspond to the inputs with the shape (batch, height, width, channels) but the channels will correspond to inputs with the core shape (batch, channels, height, width). It will be the default for the image_data_format value found in your keras configuration file in ~ / .keras / keras.json. If you do not set it up, it will be "channels_last". And finally iv. Activation- Function to use (see activations). If you do not specify anything, any activation does not apply (ie "linear" activation: a (x) = x).

4. CONCLUSION AND FUTURE SCOPE

In this paper, we proposed a Digital health care portable monitoring system for vehicles using sensors to save human life as soon as possible. Sensors like Heart rate sensor and piezoelectric sensors with tensorflow-enabled camera and signal processed data are transmitted to the concerned person, nearby hospitals or ambulance and police station. We also include smart phone mobile and GPS to get messages with current health condition and real time position of the person. This system not only meet practical use, but also promotes development of Digital health system in real time for vehicles. In addition, this system is valuable for the lower cost architecture possibility at the helmet and making responsive seat of the vehicle.

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