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Alcohol Consumption Detection Using Smart Helmet System

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ABSTRACT

Internet of Things (IoT) consists of smart devices which can sense the environment and performs the data interaction with the users by handling the large volume of data and also provide the numerous services to the users. It also plays the significant role in Intelligent Transportation System (ITS) using the Cognition ability. One of the primary causes for the road accidents is consumption of alcohol. Driving under the influence (DUI) or Driving While Intoxicated (DWI), and involves operating a vehicle with Blood Alcohol Content (BAC) level of at least 0.08 percent is considered as the punishable offense. In order to identify and prevent the driving with alcohol consumption, the ITS system can be designed with IoT based smart helmet system. The IoT system performs the data validation using the Bayesian Algorithm which significantly detects the alcohol consumption of the rider. And the system also provides the provision to control and ride the bike if and only if the rider does not consume the alcohol.

Keywords : IoT, Edge Computing, Bayesian Network, Optimization and MQ Sensor.

I. INTRODUCTION

Internet of Things is a system that admits objects to be perceived or operated remotely across existing network infrastructure, creating opportunities for more direct consolidation of the physical world into computer based systems, and resulting in developed efficiency, accuracy and economic welfare in addition to decreased human intervention.

In IoT, the routine things that employ integrated technology to communicate and interact with the extrinsic environment, all via the internet. Projected prototype as a global network of machines with sensor and devices are adequate to of interacting with each other embodies the abstract view of the IoT. In IoT, the direct and indirect view of the elements in a real world surroundings with the sensing of the computer-generated selective information is modeled using the aggregate sensory devices. IoT is a flourishing trend with a powerful influence in shaping the exploitation of the Information And Communication Technology (ICT) sector.

Today, the IoT embraces a broad diversity of particulars used in our daily lives, including radio communication frequency recognition (RFID) tags, sensing elements, actuators, and even smart devices like mobile phones. A specific addressing method enables these objects to intercommunicate and

interact with other items to accomplish common destinations. In practice, the IoT [2,3] is anticipated to formulate in domains such as radiocommunication sensor networks with the aim of accumulating contextual data. Procession is also being constructed in service-oriented architecture (SOA), which is a software system overture to expanding web-based services employing the potentialities of IoT.

IoT technology [8] furnishes the hypothesis to associate sensors, actuators or additional devices to the cyberspace and is conceptualized as an enabling technology to realize the vision of a worldwide infrastructure of networked physical objects. IoT expands the cyberspace into our everyday lives by wirelessly associating several smart objects, and will bring substantial changes in the way we live and interact with smart devices. Various companies are exploring this area as it can potentially unlock the door to new concern opportunities.

Envisioned paradigm as a global network of machines with sensor and devices are capable of interacting with each other is the technical view of the IoT. In IoT, the direct and indirect view of the elements in a real world environment with the perception of the computer-generated information is modeled using the multiple sensory devices. However, with the predicted explosion in the number of IoT services and connected devices, traditional centralized cloud architectures, in which computing and storage resources are concentrated in a few large data centers, will inevitably lead to excessive network load, end-to-end service latencies, and unbearable energy costs.

In order to meet the tight QoS requirements associated with real-time IoT applications while maximizing overall efficiency, cloud architectures are becoming increasingly distributed, with the presence of small cloud nodes at the edge of the network, referred to as cloudlets, micro-clouds, fog nodes, or simply edge cloud nodes. The resulting cloud infrastructure may be organized into hierarchical layers, each with different computing and storage capabilities. In addition, thanks to recent advances in mobile computing and device layer virtualization, even end devices can become part of this highly distributed networked compute platform, creating what we refer to as IoT-Cloud networks. These are highly virtualized heterogeneous computing, storage, and networking services with distribution and proximity to the end user.

Alcohol is the primary threat for the human life which is also proportional to the order of economic development. BAC is a value that indicates [6] the content level or grade of alcohol in the human blood. The metric is accounted based on alcohol consumption level and emissions during the breathing process of the human. Both types of validations are employed as components of the BAC because of their substantial influence on human life.

The presence of alcohol in human blood has become the major reason of lung concerned diseases to the urban dwellers due to preserved exposure. Consorting to World Health Organization (WHO), alcohol is one of the most dangerous threats and almost nearly 6.6 million inhabit died in world per year. The quantified information is formalized by utilising the component standardization and post-processing. By observing long duration time-series data regulatory conclusions are made.

II. RELATED WORK

Alcohol consumption in human civilization areas has a drastic event on humans life [14] and to their social activity. An extended number of works have been accounted in the literature that employ alcohol compution conducted by individuals. Breathing air comprises a mixture of gases, microscopic solid and liquid molecules. Some contents come from instinctive sources while the remaining are stimulated by human activities. BAC is accomplished to evaluate the level of alcohol in human blood, check

compliance with national legislation which allow to validate their driving activity with the alcohol consumption and render the information. It is therefore vital to perpetually monitor the alcohol comption in order to observe disapproving conditions that must be invalidated.

The IoT technology [2, 13, 19] also promotes the use of such methodology to be employed in ascertaining alcohol consumption monitoring and observing consumption level induced by human. Unsafe components relevant to the alcohol can be sensed using a wireless sensor network (WSN), and it is potential to expand a system adequate to of monitoring and detecting the consumption level in human civilization. Data collected from the sensor can be distributed through IOT technology and accessed using web-based technology. MQ-3 sensor can be to observe in domestic security systems, if the gas range greater a predetermined boundary, the system will render data [17] using notifications in the form of short message services (SMS).

Likewise, the MQ-3 sensor is used to observe a assortment of harmful gases such as propane, butane, carbon monixide (CO), cigarette smoke, alcohol and so on, the subsequent system can find harmful gases [20] and generate an advance cautionary system in the form of buzzer notification in driving environment. Due to the significance of investigation on the sensing of these gases, subsequently emerging some researches that do progress by applying mobile applications utilising the smartphones. As the human move around the city, BAC information is obtained. This assists in easier sustainment than immoveable monitoring stations. However, all these components render alcohol consumption monitoring at the large scale.

The problem is similar to the monitoring of the air quality which is indicated by the metric AQI. To measure an individual's pollution footprint, fine granulated air quality monitoring is required. One of the first step by using crowdsourcing for air quality monitoring applications [10] was taken by the project MESSAGE (Mobile Environmental Sensing System Across Grid Environments) from Cambridge University and partners in the UK. They constitute that, low cost components when deployed in high concentrations, can establish a much more precise picture of the spatial and temporal structure of air quality in the urban environment.

The technological community has been developing advanced choices to assess air pollution using WSN. Nevertheless, various studies have been performed conventionally. In reference to low-power radio receiver communication protocols have used ZigBee method (based on the IEEE 802.15.4). Conversely, in this work the NRF24L01 radio frequency transceiver component, which has progressed energy management, was used. The NRF24L01 [4] has an improved Shock- Burst hardware protocol accelerator, which helps to implement a robust and advanced wireless network with affordable cost micro-controllers. In relation to the connection platform for the various types of nodes, the study developed used Octopus II. The sensor node applied had a humidity sensor, temperature and a CO sensor.

The method is developed using the similar device with the difference that the 501A Dust Sensor module (DSM501A) was added, which was developed to observe molecules which are larger than 1μm. The Waspmote platform was used to achieve the lower energy consumption. The nodes [6] were developed to check the gases such as carbon monoxide (CO), nitrogen dioxide (NO2), sulfur dioxide (SO2), ozone (O3), metals such as lead (Pb). For the association of various sensors, various models of the Arduino platform is used in the monitoring circuit. For instance, in [6] the Arduino Mega 128 microcontroller was coupled together with the MQ-7 sensitive gas sensor detector in order to identify CO. Another system [3] is developed with the temperature and proportionate humidity monitoring and the corresponding environmental data were accumulated using the SHT11 and SHT75 sensors, respectively. The method is use the predesigned sensor node, called CanarIT was utilized, which contains various sensors. Collected information from each sensor node were

stored in the cloud by using GPRS communication. Smoke sensor is used to detect CO from the monitoring vehicle, if the identified level of pollution exceeds the degree permitted by the government, the microcontroller will activate the buzzer and show the air pollution range and the corresponding details on the LCD screen. Additionally, this method is also send a text notification message to a service center using GSM module.

III. SYSTEM DESIGN AND IMPLEMENTATION

The principal objective of the system constitutes to explore hypotheses of acquiring exhaustive cognition from assorted sensors using mobile participatory sensing. To accomplish this goal, we establish system to incorporate daily activities from smartphone sensors with alcohol level information. Participatory BAC perception doesn't extinguish the demand for external sensor networks, no matter inactive or nomadic.

A. Detection methodology

B.

The system is developed using the arduino as embedded controller and the IoT database is configured using the Firebase. MQ-3 sensor are used to perform the alcohol sensing process. This sensor contains a sensing element, mainly aluminium-oxide based ceramic, coated with Tin dioxide, enclosed in a stainless steel mesh. Sensing element has six connecting legs attached to it. Two leads are responsible for heating the sensing element, the other four are used for output signals.

Oxygen gets adsorbed on the surface of sensing substantial when it is heated in air at high temperature. Then donor electrons acquaint in tin oxide are attracted towards this oxygen, thus precluding the current flow. When repressing gases are present, these oxygen molecules respond with the abridging gases thereby decreasing the surface density of the adsorbed oxygen. Now electric current can stream through the sensor, which generated linear voltage values. These electric potential values are calculated to know the concentration of gas. Electric potential values are greater when the concentration of gas is high.

Gas detectors may be expected by workers and/or placed throughout a work place and could discover gases in the environment but it is not suit to check the human alcohol consumption level. Gas detectors perhaps operable to alert a user and/or supervisor when a harmful gas or degree of gas is discovered. To assure that gas detectors are operating in good order, the sensors may be sporadically fine-tuned (or zeroed). Some standardisation technique may demand allowing purified or percolated air to the gas detector and calibrating the resultant indications to a zero point of reference.

A technique for completing a calibration method for a gas detector furnishing the gas detector constituting a probe, wherein the examine constitutes: The housing operable come with a main body of the gas detector, and functional to appreciation a standardisation tube during standardisation of the gas detector; The cap functional to attach to the housing, and operable to accommodate over and compensate the standardisation tube; and one or additional inlets, wherein when the standardisation tube is enclosed into the probe, the air flows through the standardisation tube, and wherein the standardisation tube contains activated carbon filter (ACF) substantial and the disclosing a component of the standardisation tube to admit air flow through the standardisation tube; enclosing the standardisation tube into the housing of the probe with attaching the ceiling of the probe onto the housing, wherein the cap bindings the standardisation tube. The discharging calibration of the gas detector while the standardisation tube is enclosed into the probe and dispatching the standardisation electron tube from the probe; and also incurring gas indications by the gas detector.

In clean air without alcohol, donor electrons in tin dioxide are pulled toward oxygen which comprises to adsorbe on the surface of the sensing substantial, preventing current flow. In the presence of shortening gases, the surface concentration of adsorbed oxygen decreases as it responds with the reducing gases. Electrons are then expelled into the tin dioxide, permitting electric current to flow freely through the sensor. When semiconductor atoms (generally tin dioxide) are heated in air at eminent temperature, oxygen is adsorbed on the atom surface by conquering free electrons. The depletion layer thus constituted is mostly dependent on the spoke of semiconductor atoms applied. If it is as low as conventionally utilised in gas sensors (tens nano-meters), the depletion can broaden up to the entire region of each atom (volume depletion, high sensitive). If the size is far greater, on the other hand, depletion takes place conventionally on the periphery of each particle (regional depletion, low sensitive).

In the implementation phase, ESP8266 device is connected with arduino using the connection interface. Wifi package is imported in the microcontroller from the arduino library. SSID and the Password of the wifi network are used as credential to access the internet. Once the serial communication is initiated in the arduino device then the wireless interface of the microcontroller connects to the wifi network. Upon completion of the successful connection, the IP address of the displayed. Firebase database is configured in the server and the credentials to access the firebase are maintained in the arduino microcontroller.

Vcc and Gnd pins of the MQ-3 sensor are connected with the 5V and Gnd pins of the arduino. Analog data output of the sensor is connected to Analog pin (A0) of the arduino microcontroller. Based on the input voltage given by the arduino, MQ sensor are calibrated to provide accurate values. The voltage that the sensor outputs changes accordingly to the smoke/gas level that exists in the atmosphere. The sensor outputs a voltage that is proportional to the concentration of alcohol.

Once the interface connections are established then the sensed values are collected from the microcontroller. We declare the analog pin to which our alcohol sensor is connected i.e Analog pin 0. Then read alcohol function is invoked which gives us the analog value as determined by the alcohol sensor. In other words, the relationship between voltage and gas concentration is the following:

- ✓ The greater the gas concentration, the greater the output voltage
- ✓ The lower the gas concentration, the lower the output voltage

The output can be an analog signal (A0) that can be read with an analog input of the Arduino or a digital output (D0) that can be read with a digital input of the Arduino.

IV. CONCLUSION

In ITS, Driving under the influence (DUI) which is represented as the Drunk and Drive that involves to operating the vehicle with consumption of alcohol is considered as the punishable offense. In order to identify and prevent the driving with alcohol consumption, the ITS system is designed with IoT based smart helmet system. This automatically checks whether the person is wearing the helmet and has non- alcoholic breath while driving. Upon successful validations, the provision is made to operate the vehicle. The system is collaborated with the Bayesian learning model which is used to reduce computation complexity and improves the alcohol detection process.

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