

# Smart automatic petrol pump system based on internet of things

Zahra'a M. Baqir, Hassan J. Motlak

Department of Electrical and Electronic Engineering, Babylon University, Iraq

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## ABSTRACT

IoT is that a rapid expanding program presently for blend all equipment things like (sensors, gadgets, hardware and so on) assemble and embed those with programming creating our own gadgets use The petroleum pump is these days running physically. It's an activity that fundamentally a drawnout time and requires more workforce. Additionally, put fuel stations in away zones is extremely costly. So achievement an automatic fuel filling system using web technology to solve these problems. There are dense proposed systems which goal to improve the fueling operation so as to form it less difficulty and more dependabl and more-safe, guarinte that the purchaser gets the same quantity of fuel in interchange for what he/she pays, so assist to end fraud at different fuel stations. These systems take human-software interaction by the web-enabeled procedure, thus keep off all errors made by people. The fundamental objective of this review paper is to survey of recent projects in design protype of smart petro pump based on RFID as payment tool and control on it remotely with high security level and concluded with future potential direction in design of smart petrol pump system.

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## Corresponding Author:

Zahra'a M. Baqir

Department of Electrical and Electronical Engineering

Babylon University

Babylon, Iraq

Email: zmbhmaly@gmail.com

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## 1. INTRODUCTION

Petrol pumps are operated manually making fuel dispensing and filling, a time-consuming procedure [1]. The progression of innovation has added to the wellbeing and security of people alongside their property and make life increasingly simpler [2-4]. Especially, one of the most significant features of utilizing the renewal in gas stations is offering types of helps to individuals particularly give unwavering quality and security [5-7]. The smart gas station has advanced frameworks through which can be controlled a portion of the things in a gas station, for example, lights, and it can legitimize vitality utilization, and different capacities by utilizing sensors [8].

In general, designing a smart feul pump is one way to assess the level of a gas station system [9, 10]. The thought on a smart petrol pump includes three basic characteristics. firstly, reconnaissance is significant through sensor systems to get data or information concerning the station. Secondly, instruments control the utilization of correspondence between gadgets to permit computerization and faraway access. At long last, UIs like advanced mobile phones and PCs permit clients to allot needs add to introduce data to individuals about these prioreties [5, 11-14].

In the course of recent years, various methodologies have been executed to structure a smart petroleum pump. This paper plans to audit current methodologies for planning brilliant petroleum pump

frameworks with low expenses by controlling and observing utilizing microcontrollers and exploit present day innovation, for example, cell phones to control numerous gadgets dependent on IoT [15].

The remainder of this paper is organized as follows. Section 2 gives the background of internet of things (IoT) and radio frequency identification (RFID) concepts, structure and components, etc. Section 3 presents smart petrol pump using RFID and IoT. Section 4 discusses the drawback of state of the art works and Section 5 present conclusion and future works to address.

## 2. IOT USING RFID TECHNOLOGY ARCHITECTURE

In this section, overview of internet of thing (IoT) architecture and its application in smart petrol pump was studied based on prior researches.

### 2.1. Overview of internet of things (IoT) architecture

It is mostly perceived that the cutting edge web will be the IoT which statement individuals and things to be associated whenever, wherever, with anything and anybody, preferably profit any way/organize and any help [16-18], as shown in Figure 1. Radio recurrence recognizable proof innovation is for the most part observed as a key empowering influence of the web of things, on account of its capacity to help machines or PCs to distinguish items and track an enormous number of remarkably recognizable articles, minimal effort, little size and low-upkeep highlights [19, 20]. For example, the electronic product code class-1 generation-2 (EPC C1 G2) ultra high frequency (UHF) passive RFID protocol allows low-cost tags and has been widely used in supply chains [20]. Arranged RFID frameworks through servers are required because of the constraint of understanding reach and the basic structure of labels, and ordinarily have a various leveled structure comprises of three principle layers: an upper system, a center system and a lower organize as appeared in Figure 2. There are three primary kinds of segments: servers, perusers and labels. They are associated in three-chain of importance systems [20].



Figure 1. Internet of things connectivity

In the upper network, servers connecting to reader clusters via wired (such as universal serial bus (USB), recommended standard-232 (RS-232), Ethernet, etc.) or wireless such as wireless fidelity (WiFi), global system for mobile communications/general packet radio services (GSM/GPRS), global positioning system (GPS), Zigbee, worldwide interoperability for microwave access (WiMAX), etc. connection. One reader cluster may have one reader or multiple readers [21, 22]. Servers (database servers and remote control servers) could be computers [23]. They store and procedure all data detailed from perusers. Servers are likewise doors to outer Internet and can be gotten to by cell phones and different PCs by means of online administrations [24]. In the middle network, readers within a reader cluster can be ad hoc connected. The aim of the middle network is to provide efficient cooperation of readers and deal with reader collisions. In the lower network, passive RFID protocols, such as EPC C1 G2 protocol, are adopted to mitigate tag collisions and collect sensing information from tags. The IoT system architecture is generally divided into three layers from the field data acquisition layer (sensing layer) at the bottom to the application layer at the top [25] as shown in Figure 3.

- a. Sensing layer collects and gathers physical parameters such as the temperature, humidity, and air composition. It comprises:
  - Data acquisition devices that gather the data and information by various data collection technologies such as RFID, UWB, near field communication (NFC), camera, sensors and etc.

- Collaboration networks that are formed by interconnecting the data acquisition devices such as wireless sensor network (WSN), Ad hoc network.
- b. Network layer is on the middle of the Internet of Things architecture. It is heterogeneous networks including the next generation network, Internet, mobile communication network, wireless local area network (WLAN), satellite communication network, GPS, and etc. The main purpose of the network layer is to perform the functions of transmission, information processing, and network management. This information is received from the sensing layer through different networks. Protocols for communication such as IPV6 are applied in this layer.
- c. Application layer incorporates the help sub-layer and the administration sub-layer. The help sub-layer conveys data as per clients' solicitations. Appropriated figuring innovations, for example, distributed (P2P) and distributed computing, are used to brilliantly process and break down a huge swath of information. General gadget discovering, nature of administration (QoS), and security control are upheld through middleware and object name goal [26]. Monstrous information stockpiling, distributed computing, information mining, and wise data handling are a portion of the exploration subjects on this sub-layer. In view of the help sublayer, the administration sub-layer gives interfaces and stages from an extensible assistance structure [27]. Common applications incorporate food detectability, constant limitation, natural reconnaissance, vehicle booking, etc [28]

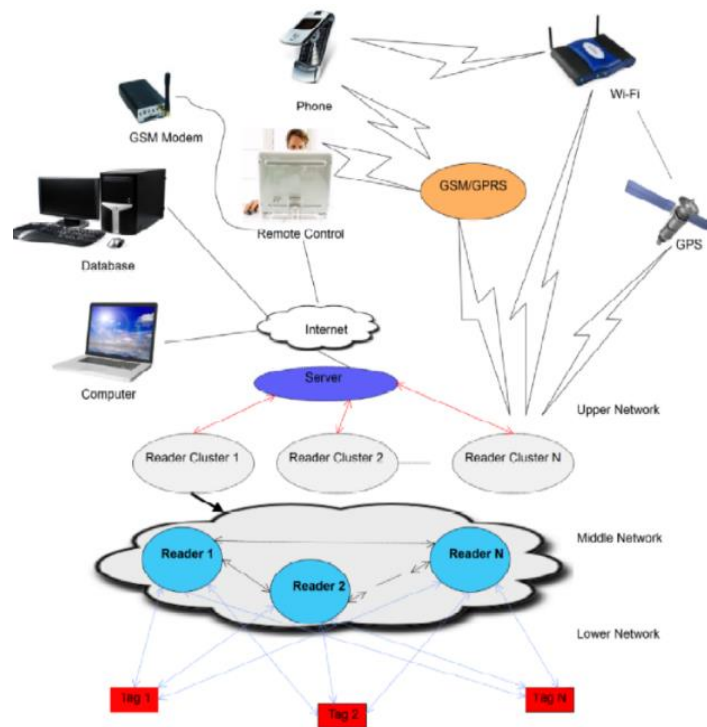


Figure 2. Anetworked RFID system, hierarchical view

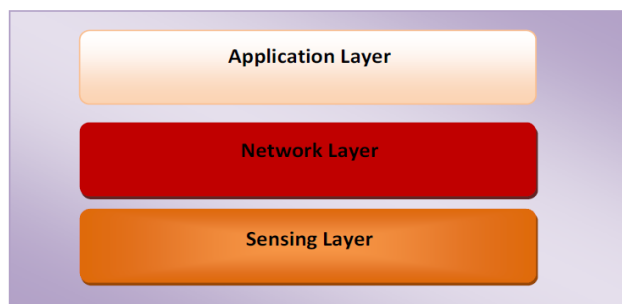


Figure 3. Architecture of IoT

## 2.2. Overview of RFID system architecture

RFID is a programmed distinguishing proof innovation, which utilizes remote radio correspondences to remarkably recognize articles or individuals, and is one of the quickest developing automatic data collection (ADC) advancements, for example, standardized identification, attractive inks, optical character acknowledgment, voice acknowledgment, contact memory, brilliant cards, biometrics and so on [29-32]. This innovation isn't altered; actually, it is as of now being utilized in various applications all through the world. It was initially actualized during World War II to distinguish and verify partnered planes, in a recognizable proof framework known as ID companion or enemy, is as yet being utilized today for similar purposes [33]. RFID innovation, in correlation with scanner tag, conquers certain restrictions found in certain applications. Since it is longer understood range, supporting bigger memory and not requiring view. Likewise RFID transmits information remotely and is a perused/compose innovation, so it can refresh or change the information encoded in the tag during the following cycle [16, 34]. A basic RFID framework is appeared in Figure 4, which includes at least one perusers and RF labels in which a peruser sends information, power and the clock to labels. The labels react to the orders of the peruser utilizing the backscattering method. Perusers contain sequential information interfaces such RS232, RS485 to RFID server which catches information from perusers and afterward keenly channel and course the information to neighborhood passageway and web-servers [22, 35, 36].



Figure 4. The basic model of networked RFID system

### 2.2.1. RFID tag

The tag contains the data which is transmitted to the reader when the tag is inquired by the reader [37]. The most widely recognized labels today incorporate a receiving wire and an integrated circuit (IC) with memory, which is basically microchips chip. The label types are typically grouped based after controlling modes: dynamic, semi-alooof, and detached tag. The principle properties of three distinct labels are as appeared in Table 1.

Table 1. The properties of three different tags at frequency (UHF)

Type	Power Supply	Operation Life	Size	Cost	Read Range
Active Tag	With battery	$\frac{1}{2}$ – 5 years	Large, thick, heavy	Expensive	1-100m
Semi-Passive Tag	With battery	$\frac{1}{2}$ – 5 years	Large, thick, heavy	Intermediate	Up to 5m
Passive Tag	Without battery	3-10 years	Small, thin, light	Inexpensive	1-10m

### 2.2.2. RFID reader

The reader is a gadget intended to distinguish and peruse labels to get the data put away subsequently, and is likewise liable for imparts that data to a server [16]. On account of inactive and semiactive labels, the peruser gives the vitality required to initiate or empower the tag in the peruser's electromagnetic field. The range of this field is commonly dictated by the size of the radio wire on the two sides and the intensity of the peruser. The size of the reception apparatus is commonly characterized by application prerequisites. Be that as it may, the intensity of the reader, which characterizes the force and reach of the electromagnetic field created, is commonly restricted by guidelines. Every nation has its own arrangement of principles and guidelines identifying with the measure of intensity created at different frequencies [29].

### 2.2.3. RFID server

The RFID server is a host computer fundamentally used for data pilling and information running. Data management system can be the easy local software which merged in RFID running module [38]. In briefly, tag and reader are responsible for identifying and capturing data, RFID server is responsible for managing and manipulating the data transmitted.

## 3. SMART PETROL PUMP USING RFID AND IoT

Smart petrol pump system implementation in different countries can be accessed in many literatures all these projectes used RFID card as payment card. In [5], this paper presents the design and implementation of smart petrol pump in which we are going to measure the level of fuel in the gas station and show it to the central server. If the fuel level is low then the central will provide fuel supply to that station. Their motive is to create a website which takes the fuel level as input from the fuel station where hardware is installed then rerum it to the site which is accessible by admin and users. Admin can change the data and update it. Users cannot change the data but they will only see it. They use ultrasonic sensor which measures the level of fuel. In [39], this paper, it deals with automation of fuel station retail outlet; this system will give the sales and stock report to the owner for every hour. In this proposal the client can get to the current status of the fuel station just as the stock upkeep through the web application. Through this we can use time in effective way and labor likewise and afterward this proposed framework is intended to include a security for the e-adjustment unit in the fuel pump.

In [6], this venture, the client having the shrewd card. The card is nothing; attractive memberis inserted in the card. The peruser circuit produces superb sign to peruse the magnificent number. At the point when client shows this card on the peruser, the peruser peruses that grand number and given the comparing sign to microcontroller. In [40], this paper utilizes biotelemetry framework to verify the individual client with their petro card. The biotelemetry here utilized as a unique mark sensor. The drunk and drive accidents are diminished by utilizing the liquor sensor in Petrol bunks. The liquor sensor detects the liquor focus in the blood by relaxing. In [41], this paper, built up a robotized fuel station the board framework which can defeat the drawbacks of present framework. We executed programmed fuel filling framework by utilizing GSM and AT mega 328. This framework can improve the fuelling procedure so as to make it simpler, solid and secure.

In [7], this venture is to actualize the security framework for filling petroleum at the Petrol bunks by keeping away from the association of individuals. RFID shrewd card maintains a strategic distance from the danger of conveying cash without fail and furthermore gives the element of paid ahead of time revive. In [42], the straightforward and appropriate utilization of microcontroller and GSM innovation gives an absolute security and atomization in the dispersion of fuel. It has simple worked cell phone framework and designs UI (GUI). It interfaces with fast fuel container which is advantageous for the buyer to work. In this framework the secret word will be given to the client and client needs to enter this secret word on the LCD gave by the fuel station which will enable the petroleum to organization to make validation for the client additionally the appropriation of the fuel is unimaginable until it gets confirmed by the database. In [43], the fundamental point of the task is to structure a framework which is prepared to do naturally deducting the measure of petroleum administered from client card dependent on RFID innovation. This paper proposes the usage of RFID innovation in controlling fuel apportioning for an Indian urban communities. In [44], this paper proposed petroleum siphon station utilizes Arduino mega as the primary cerebrum for its siphoning equipment framework and Texas Instrument CC3000 Wi-Fi shield is utilized to build up remote association between the petroleum siphon and the control framework. The petroleum siphon control framework is made utilizing HTML to screen and control the siphon station as far as deals, security and petroleum amount inside thousand miles away. Other than that, the control framework programming likewise gives a couple of different capacities, for example, to set the petroleum cost and as far as possible. These checking and controlling procedure are finished by sending and getting of the information between the CC3000 Wi-Fi Shield and the nearby server. In [45], this paper implements the Automation of the filling fuel at petrol bunk using RFID and GSM technology. The transactions are made customer friendly i.e., it has the ease of operation at customer's fingertips with customer's smart phone [46]. This we realized mechanized oil siphon by using GSM and RFID. In this system, all clients have a particular card called RFID card which can be stimulated by a couple centers. The gas station is equipped with a keen card peruser which recognizes the sum in the card alongside all the security subtleties and will show it on the LCD. In [47], this paper represent the mentioned system by aid of modern programs (Labview, Protues, PIC C Compiler) to achieve a high accurate control of the required parameters, in addition to using SCADA for supervising and controlling all the system to avoid any unexpected faults; like fire catastrophe and making the system work with high accuracy. Table 2 shows a number of designs that have already been suggested in designing a smart fuel pump.

Table 2. List of smart petrol pumps approaches according to cores, sensors, communication between devices and user interfaces

Ref	Core	User Interface for Control	Sensors	Comm. Teq.
[3]	Intel Galileo Gen 2	Web page	Ultra sonic sensor HCSR04	Wifi module
[18] [6]	Arduino MEGA ARM 7 LPC2148 Microcontroller	windows application Mobile phone	Temp. soil moisture <i>IR sensors</i> ,	AZUR IOT HUB GSM
[19]	MICROCONTROLLER (ATMEGA 8A)	Host pc	ALCOHOL sensor & Fingerprint sensor	RS 232
[20] [10]	At Mega 328 Raspberry pi3 (ARM8)	Mobile phone Web page	Temperature sensor Level sensor <i>IRIS sensor</i>	GSM WIFI
[21] [22]	Microcontroller AT89S52 Microcontroller AT89C52	Mobile phone LCD		GSM UART
[23]	Arduino Mega & Texas Instrument CC3000 Wi-Fi Shield	Web page	Ultrasonic sensor	WIFI
[24]	ARM-7 CONTROLLER (LPC-2148)	Web page	Level sensor Smoke sensor	GSM
[25] [26]	ARM7 LPC 2148 PIC microcontroller PIC16f877A	Mobile phone Pc control system (labview)	fire sensors Temperature sensor & fuel sensor	GSM Serial interface unit

#### 4. RESULTS AND DISCUSSIONS

For the past few years, there was quite a lot of research focusing on design of prototype of petrol pump system based on RFID and IoT. However, this prototype architecture which consists of feature descriptors and extractors are problem-dependent. In other words, those prototype features can only apply to specific problems. It could not be used for other problems which is irrelevant to apply in a real scenario. Apart from that, the smart petrol pump architecture in these designs used could only extract low-level security, it is very challenging in capturing for high-level secure information [48]. Thus, the advancement in technology leads to the emergence of deep learning-based sport video analysis. Thus, the advancement in technology leads to the high level of security in design of petrol pump system when suggest another tool as core to control and hybrid communication technique between devices for these pump system and user interfaces. Since smart petrol pump-based RFID and IoT is still a new and growing research field, there were only a few studies found. Most of the studies are focusing on low-cost features [49]. However, the main drawback of using prototype with high level security are its expensive cost meaning to gain secure features automatically increase cost of project [50]. Besides, to elevate the performance level of the prototype model it needs high-performance GPUs [51]. But, the recent advancement in technology and the growth in big data have overcome these issues.

Previously, arduino with raspberry pi as core of prototype which is one of the approach has shown success in image recognition [52]. However, in the analysis of video input data researchers face many challenges because video sequences dynamically evolve with time. It is difficult to extract temporal information. With the continuous study in video analysis using arduino with raspberry pi. These approaches are able to extract temporal information in video input data. There were some researches work on the combination of both RFID as payment tool and control remotely on petrol pump system using hybrid cores extract spatio-temporal information to rise security level. But only a few researches were found in extraction high-level secure information transmission. Despite astonishing performance of smart petrol system based RFID and IoT, the advancement achieves in image classification and low-cost have not been reached in certain field like video classification and rise security. It is still an open issue in smart petrol pump-based research in which many researchers try to solve and it is an ongoing research work.

#### 5. CONCLUSION

This paper contributes a comprehensive survey on design of prototype of petrol pump system by overview both smart petrol pump based on RFID and IoT approach. In summary, smart petrol pump with hybrid core approach has overcome the limitations encountered by traditional methods in activity recognition of video analysis and rise security level for transmission information and control on it remotely. However, only a few research has focused on video analysis and hybrid technique. So, in future studies, the researchers can focus on extraction high-level secure information in design smart petrol pump which will be used by customers to gain time and reliable and more secure performance. Moreover, future research should also concentrate more on hybrid communication between devices to rise security level of design smart petrol pump.

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