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A Hybrid Approach to Traffic Management: Automated and Semi-Automatic Light Control System Design

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Abstract— The cars waste a lot of fuel and surely the driver waste a lot of time. To solve and monitor the traffic light system and make it more efficient , we have to use an intelligent technique taking the advantage of the sensors, microcontroller and the GSM modem which could add the real time benefit to the system. This paper explores the design of semi automatic traffic light control system. The traffic light is designed using microcontroller ATMEGA32 programmed by BASCOM AVR, power supply , IR sensor and GSM modem . The system solves the wasting time and fuel problem and the problem of the emergency car which waits a lot in the road intersection as well as it solves the problem of the congestion that occurs when an accident in the path happens. The system can be used for the traffic at the road intersections...

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I. INTRODUCTION

The Traffic Light Controllers are based on the microcontrollers and the microprocessors. These Traffic Light Controllers have some limitations due to using a pre-defined hardware, which is programmed according to fixed time that never change. Hence, there is no flexibility of modification on real time basis. Due to the fixed time for the three color signals ,the waiting time is more and cars waste more fuel. The goal of the driver is to reach at destination without wasting time and money. But the resources provided by the current infrastructures are limited. So the traffic management at road is crucial to reduce waiting and traveling times, save fuel and money. Many times accidents happen due to the poor performance of the system . The proposed system provides the map feature, which controls the traffic on request. The traffic density is increasing at an alarming rate in developing countries which calls for the need of advance intelligent traffic signals to replace the conventional manual and time based traffic signal system .The system should give priority to the density of traffic on the roads .This can be done by making a bridge with IR sensor on the road intersections and make the decision according to the information that the sensor senses. The timings of the traffic lights at each crossing of road will be intelligently decided based on the total traffic on all adjacent roads. Thus, optimization of traffic light switching increases road capacity and traffic flow, and can prevent traffic congestions.The primary role of a microcontroller unit in an embedded system is to provide inexpensive, programmable logic control and interfacing to external devices. This means microcontroller unit typically is not required to provide complex functions. It is well suited for monitoring a selected variety of inputs and responding to them in real time using the preprogrammed instructions that are executed by the built in processor. An embedded microcontroller can respond to these inputs with a wide variety of devices. The IR sensor detects vehicles. To detect the emergency vehicles, The GSM modem will be used to receive signal from user and send signal to the microcontroller to change the state of the traffic light , the GSM also reduce the congestion's problem that happen after the accident, by change the lane's traffic light to stop mode. In this paper, intelligent traffic light controller based on microcontroller system was implemented using the IR sensor and GSM system to provide users who wish to obtain the latest position of traffic on congested roads. 2 APPROACH The paper covers the area of microcontroller based system , data acquisition , interfacing and wireless data exchange . The system design method will be divided into three phases as follows : Phase one : the sensing unit. Phase two : control algorithm . Phase three : GSM model. The figure (1) below shows the block diagram for the system.

The designed system can operate in three modes of operations. Mode one : Normal traffic operation .(i.e. No emergency cars are requesting passage and no accident occurs) . Here , the traffic lights will operate according to the equation no. (1) below; Traffic lights timing (TN) α Density of traffic on the lane (D) ……(1) Mode two : Emergency traffic operation .(i.e. Emergency cars are requesting passage and no accident occurs) . Here , the system will give lane passage command and traffic lights will operate according to the equation no. (2) below; Lane emergency timing (TE) α Duration emergency car passage (E) … (2) Mode three : accident traffic operation .(i.e. No emergency cars are requesting passage and an accident occurs) . Here , the system will give divert commands and traffic lights will operate according to the equation no. (3) below; Accident timing (TA) α Duration for settling the

accident (A) …… (3) 3 SYSTEM COMPONENTS 3.1 The GSM system : The GSM-III alarm base system is interfaced to the microcontroller . It sends and receives SMS messages .The GSM provides the microcontroller with the commands and accordingly gives response based on the program embedded in the microcontroller. Figure (2) shows the GSM-III alarm base system. Figure (2) GSM-III alarm base system 3.2. PC Computer: PC computer is used to program the microcontroller . The BASCOM language is used to program the microcontroller. A lab link connects the PC to the microcontroller while programming. 3.3 HD74LS373 Latching IC: The HD74LS373 is eight bit is register IO mapped used as a buffer which is` used for storage of data. Different types of latches are available HD74LS373 octal D-type transparent latch will be used in this system. This type of latch is suitable for driving high capacitive and impedance loads. 3.4 ULN 2001A Darlington IC: The ULN2803A is a high-voltage, high-current Darlington transistor array. The device consists of eight NPN Darlington pairs that feature high-voltage outputs with common-cathode clamp diodes for switching inductive loads. The collectorcurrent rating of each Darlington pair is 500 mA. The Darlington pairs may be connected in parallel for higher current capability. 3.5. Traffic lights : Three different colour lamps are used (RED , ORANGE , GREEN). 3.6. ATMEGA 32 microcontroller : It is programmed to perform the tasks in the system. 4 ALGORITHM The microcontroller algorithm includes a sequence of steps for the operation of the traffic system . The algorithm is ;Start --- Normal mode : This mode counts the traffic density and accordingly activate the traffic lights . --- Check the incoming message : - If the message comes from an emergency vehicle , then revert To the emergency operation mode of the system. - If an accident message comes from the traffic control officer , then revert to the accident operation mode of the system. - If force ending message comes , then the system reverts to end . --- If not loop to normal mode . End. 5 V. RESULTS Following are the results for the system operation. Normal operation ----◊ Traffic lights timing depends on the traffic density. Emergency mode operation ---◊ Give pass command to the lane. Accident mode operation ---◊ Divert traffic command . Table (1) below shows the resulted traffic timing relative to the cars queuing on the lane

Information on the web is huge in size and growing continuously hence it is a big challenge to identify the relevant web pages for a specific information need of the user. Research has been done for better personalizing the web search of the user using various techniques. [4][15] [20] [69] [14] [63] [12] [34] [68] [64] [50][49] [38] [51] [52] [53][54] [55][37]. It is found that hybrid of optimization technique Ant Colony Optimization (ACO) and trust have been applied successfully in various domains and results proved promising. In [65] ACO algorithm is adopted in trust model in order to simulate trust relationship between cloud entities in cloud computing. In [22] trust evaluation model is developed in P2P networks. In [5] ant algorithms have been applied to estimate the degree of trust between nodes in mobile adhoc networks. In [56] ACO algorithm has been used for reaching optimality in grid scheduling problem. In [10] a hybrid of ant colony system for predicting the recommendations in trust based recommender system is proposed which considers all the target item ratings along the solution path rather than just stopping and using the first rating found in the search process. In [59] a optimized and trusted routing in MANET is proposed where nodes with trust value above the threshold value are considered for routing and finally optimization is done using ACO to yield more optimized performance. It is found that hybrid of ACO and trust shows promising results in various domains but it is realized in this research that benefit of this hybrid can be used in query log mining for web page optimization in a given domain in order to identify relevant documents for effective web information retrieval. Thus in this paper hybrid of ACO and trust has been proposed for web page optimization using clustered query sessions. The significance of using hybrid of Trust with ACO is that use of trusted web pages for optimization will increase the quality of colonies of web pages identified using ACO and will identify

the web pages relevant to the information need of the user in a given domain. These trusted colonies of web pages in a specific domain when selected for recommendations will retrieve more and more relevant documents and improve the precision of search results. Thus user response to trusted web pages is captured to update the trust and pheromone of clusters and is used for identifying more and more trusted colonies of web pages for further recommendations. This process of recommendations and optimization continues till the web search is personalized to the information need of the user. Since the ratio of relevant documents to retrieved documents is increased hence web search will soon converge to information need of the user effectively. The flowchart of the proposed work is shown below in Fig 1.

Experiment was conducted on the data set of web search query sessions captured in three domains Academics, Enter-tainment and Sports and the results confirms the improvement in the precision of search results. The rest of sections are or-ganized as follows. section 2 discusses the related work, sec-tion 3 describes the background required for understanding the proposed approach, section 4 explains the proposed ap-proach of Domainwise web page optimization using hybrid of trust and ACO for effective Information Retrieval, section 5 presents the experimental study to analyze the effectiveness proposed approach and section 6 concludes the paper.

II. RELATED WORK

It is found that recommender system can be more effective by incorporating trust than traditional collaborative filtering. [41][46][32][9][60]. In [40] trust based recommender system is proposed using both trust metric and similarity metric. In [44] trust propagation model is proposed using number of hopes in trust propagation and the trust value is calculated between source to destination participant. In [36] a method is proposed for generating recommendations by trusted friends only. In [16] a novel trust model is developed based on recommendations in online service oriented environment. ACO is a nature in-spired metaheuristic for the solution of hard combinatorial op-timisation (CO) problems. A metaheuristic is a general-purpose algorithmic framework that defines the heuristic me-thods which can be applied to different optimization problems with relatively few modifications. [27][29][28][30] ACO has been used to solve many optimisation problems such as se-quential ordering [21], scheduling [6], assembly line balancing [7], probabilistic travelling salesman problem (TSP) [35] , DNA sequencing [8] , 2D-HP protein folding [3] and protein-ligand docking [33]. In [31] Ant Colony Optimization (ACO) is applied to build query association graphs from the query logs for the purpose of query recommendation. In [48] clustering based on ants is used to access to a variety of collaborative learning agent groups so as to fully mobilize the enthusiasm of colla-borative learning team members. In [62] the ant colony opti-mization is applied on the log data to build an adaptive domain model automatically in order to satisfy user‘s information re-quest effectively in more structured collections such as digital libraries, local Web sites, and intranets. In [39] combination of ant based clustering and fuzzy c-means is proposed. In [57] model is proposed which combines the ACO and Fuzzy logic to generate the list of recommendations to online users based on the comparison of the user‘s navigational behavior with other user‘s data. In [47] an ACO algorithm is developed called Ant-Recommender System which sense pheremones found on their clusters in order to determine the best cluster for re-commending the items with in clusters of user profiles. In [36] recommender system is proposed based on collaborative be-havior of ants by integrating trust between users. The hybrid of ACO and trust has been applied in various domains and shows promising results. It is found no work has been done which uses the hybrid of ACO and trust for effective web page optimization based on query log mining. The advantage of using hybrid of ACO and trust in query log mining for web page optimization is that it generates recommendations of relevant web pages using ACO based optimization on trusted colonies of web pages. Thus in this paper a novel approach is proposed using ACO and trust in query log mining for effective personalized web search. It is found in [53] that the perfor-mance of the Personalized Web Search was improved when converted into optimization problem and solved using Ant Co-lony optimization techniques by replacing the pheromone in ACO with Information Scent. In this paper work in [53] has been extended to apply the hybrid of trust and ACO in query log mining for identifying trusted colonies of web pages for recommendations in order to personalize the web search of the user more effectively.

III. RESULTS AND DISCUSSIONS

Chemical parameters are very important in water quality analysis for hand dug wells used for drinking and other purposes. Most of the chemical parameters are known to have health effects on users whiles others are not. Due to this, the Guidelines for Drinking Water [22] and Ghana Standard Authority guidelines were used in discussing and comparing the results obtained. The overall suitability of water from hand dug wells for drinking purpose were compared to the pipe borne water quality based on the similar tests. The results are discussed under; (a) the chemical quality of water in hand-dug wells compared to Ghana Standard Authority standards in Begoro, (b) possible health effects of chemical contaminants in hand-dug wells, (c) chemical quality of hand-dug wells whether it meets the Ghana Standard Authority standards, and (d) chemical water quality differences between the hand-dug wells and pipe borne water in Begoro community.

3.1 Comparing chemical quality of water in hand-dug wells in Begoro with Ghana Standards Authority guidelines

From table 1, the chemical quality of hand-dug wells were within the guideline limits of Ghana Standards Authority, comparatively. The values were below the guideline values. Whiles chloride values in the hand-dug wells ranged between, 200.6 mg/l to 210.5 mg/l, the Ghana standard Authority maximum value for chloride was 250.0 mg/l. Fluoride concentration in hand-dug wells ranged from 0.50mg/l to 0.90mg/l, compared to GSA‟s standard of 1.50mg/l. This means that when we compare the values in the hand dug wells to the national guidelines, the one from the hand-dug wells were lesser than the maximum considered value. Nitrate concentration in the hand-dug wells was within the guideline values of GSA. The result ranges from 10.5mg/l to 16.0mg/l; whiles the GSA value is 50mg/l. The same observation or conclusion can be made for total hardness which value was between 51.0 and 89.5mg/l and Ghana Standard Authority guideline value was 350.0mg/l. The Ghana Standards Authority (GSA) standard for chloride is 250mg/l, whiles chloride in hand-dug wells in Begoro is lower than the

3.2 Possible health effects of the chemical contaminants in hand-dug wells.

Chloride ions are non-cumulative toxins, an excessive amount of which, if taken over a period of time, can constitute a health hazard indicated by [23]. As observed in the Table 1, chloride

Pipe Borne

GSA Standards

200.6	0.50	7.3	50.0
250	1.5	50.0	350.0

level in hand-dug wells and pipe borne water were generally low, implying that there may not be any health effects by drinking water from both the hand-dug wells and the pipe borne water. Chloride concentration in excess of 250mg/l or (250ppm) gives rise to taste in water as indicated by [6]. Hand dug wells were characterized by low fluoride ion concentrations (0.50 to 0.95), and fell within WHO and Ghana Urban Water Company (GUWC) acceptable limits of drinking and potable water (1.5 mg/l). The fluoride level in the hand dug wells were also low (0.50 to 0.90mg/l), indicating that there will not be any health hazards associated with consuming of water containing fluoride. Fluoride in pipe borne water (0.50mg/l) was below the GSA guideline levels. Fluoride is expected to be present in water and higher concentrations are usually associated with ground water. Skeletal fluorosis has been evidenced in persons when water contains more than 3.60 mg/l of fluoride as observed by [9] report. Hardness is a natural characteristic of water which can enhance its palatability and consumer acceptability for drinking purposes. Health studies in several countries in recent years indicate that mortality rates from heart diseases are lower in areas with hard water indicated by [8]. Undesirable effects due to the presence of calcium and magnesium in drinking water may result in rendering water hard. Hand dug wells and pipe borne water in Begoro are characterized by moderately low (51.0-

89.0mg/l; 50.0mg/l) calcium carbonate (CaCO3) ion concentrations and are within WHO/GSA maximum acceptable limits for drinking and potable water (350 mg/l). Hence, the water is soft. In areas supplied with drinking water harder than

500 mg/l CaCO3, higher incidence of gallbladder disease, urinary stones, arthritis and atrophies as compared with those supplied with soft water are reported by [5]. Low total hardness of water indicates that health problems may not be associated with the drinking water.

WHO standards	250	1.5	50.0	350.0

Source: Laboratory Tests, 2015

3.3 Comparing chemical quality of hand-dug wells with

(GSA) standards

In Figure 1, hand-dug wells with an average value of 13.1mg/l nitrate ion concentration are shown. This means that nitrate concentration in the hand dug wells is lower than [22] edition of water quality standards, whose recommended value is 50mg/l nitrite for drinking water. This shows that, water in hand-dug wells in Begoro is safe for drinking. High values of nitrate in Figure 1, can result in algal growth and phytoplankton causing eutrophication which may adversely affect the quality of the water [22]. High nitrate levels in water for drinking are hazardous to infants since this can induce the "blue baby" syndrome or methaemoglobinaemia [22]. The syndrome also affects pregnant women with particular enzyme deficiency, adults with reduced stomach acidity, and those with deficiency in the enzyme needed to change methemoglobin back to normal hemoglobin, a condition which can be hereditary. The nitrate itself is not a direct toxicant but a health hazard if it is converted to nitrite which reacts with blood haemoglobin to cause methaemoglobinaemia [8]. Hence, comparatively, water quality values obtained in Begoro indicate that health hazards may not be associated with drinking water from hand-dug wells and pipe borne water sources in relation to nitrate concentration.

IV. CONCLUSION

The number of road's users is constantly increases; hence the need for an intelligent control of traffic becomes an important issue in the present day. However, some limitations to the usage of intelligent traffic control exist. Avoiding traffic jams for example and makes the priority always to the emergencies car is thought to be beneficial to both environment and economy.

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