The Role of Current Technology in Street Light System

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ABSTRACT

The latest trend in the technologies related to wireless communication has led to the emergence of several engineering designs for human requirements. The creeping interests in the wireless and GSM based projects, we came up with this idea of developing a simpler, multipurpose, cost-effective design to control the on-off street lights via short message service (SMS). Commands are sent to street light for night lighting Applications system through user' mobile as data through SMS (Short Service Messages) providing a cost effective, reliable far reaching access to the user. The coded SMS is sent to the light relay system to base station controller that receives the messages, decodes the messages, initiates required automation operations and responds to the successful initiations by a reply to the user.
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Keywords: Street lights, remote monitoring, Today's Technology, WSN,GSM.

1. INTRODUCTION

A Street light is a light installed at the edge of a roadway to illuminate the side of the road. The history of lighting streets and roadways is ancient, with evidence that many communities in the Ancient World encouraged citizens to keep outside lights burning through the course of the evening for navigation and safety. The earliest formal street lights operated as a municipal service were gas lights, which were hand lit by a crew of people every evening. Eventually, gas lighting was replaced with electric lighting, and street lights today are usually fully automated. The purpose of a street light is not to illuminate the roadway; at night time, drivers should be using headlights, which will illuminate the road for them. Street lights light up the side of the road, alerting drivers to potential hazards and situations which they need to be aware of. They can also be used to signal the presence of an intersection, so that a driver can be prepared for cross traffic or get ready to turn onto a side street.

GSM based street light automation is basically used to control street light automatic by the help of GSM module (global system for mobile communication).It is designed to performing & increase the efficiency of street light even more during in nights. It consists of an PIC16F873A microcontroller which on setting of time delays switches ON/OFF the street lights and sends the update through a phone to the specified phone number[1]. This is the best way of managing a street light system. There are two modules client server & server side. The client server consists of GSM module which is connected to the microcontroller. The server side consists of web server; it has a core engine which interacts with the user, database and the GSM communication manager. By applying the proposed system, streets can be illuminated with lower power consumption lamps, low operating cost, and low CO_2 emissions and environmentally friendly. it is best used without any disadvantage as compared to other.

Street lights are usually controlled manually by local authority through some local switches which is installed in their control unit. Operator must have a physical access of a control unit therefore presence of an operator is needed to be in the control unit room by the time of controlling street light.

It is also quite possible that if the operator turns on/off the specific street light from the control room but due to broken link or some other reason, the street light remains in its old state. Therefore this becomes more critical when control unit and place where street lights are actually installed are far away from each other hence a feedback is required to give acknowledgment to the operator that whether control is successfully done or not.

Two main objectives of the proposed structure are.

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➢ To monitor the status of street lights from any remote area through an SMS.

➢ To control the status of a specific street light through SMS.

For this paper, the model of street light is made of microcontroller. The model uses LED to represent the street light. This project consists of a system that will continuously sense the command SMS which has a predefined format, if received, it turn on/off the specific street light. And also it will automatically send an acknowledgment SMS to the user that this particular street light is turn on/off.

2. LITERATURE REVIEW

Literature review is a study from the previous publications that is related to this architecture. It is showing how others solve their problem to achieve their objective of the paper. Four related journal was selected as reference which is Smart Monitoring Fault Detection System for Malfunction Traffic Light, A Study of Wireless Sensor Network Architectures and Projects for Traffic Light Monitoring, Traffic Monitoring Enforcement System using Computer Vision, and GSM Based Cost Effective Street Lighting Application. Some people come with much solution while others use a simple way to solve the problem.

In addition, it will give some brief idea of the technology used for other project. The revision about the device or component that use such as GSM modem, PIC microcontroller and LED discussed in detail in proposed diagram. As a result, improvement can be made for some other benefit.

A smart monitoring fault detection system has been developed to monitor the traffic light operation in rural area or small city. The Fuzzy-Fault Identification and Fuzzy- Fault Classifications are two modules which employed as the subsystems in fault detection system. Both of the modules are used to classify the level of seriousness for traffic light failure based on two factors of failures which are electrical fault and mechanical fault. The seriousness of the traffic light failures are classified to four conditions such as normal, non-critical 1, non-critical 2 and critical and a signal will be sent to the contractor and authority department via message service for further action. Thus, it is a more effective system and has a bright prospect to be implemented in Malaysia [7]. Figure 1 shows the block diagram of fuzzy-fault identification system.
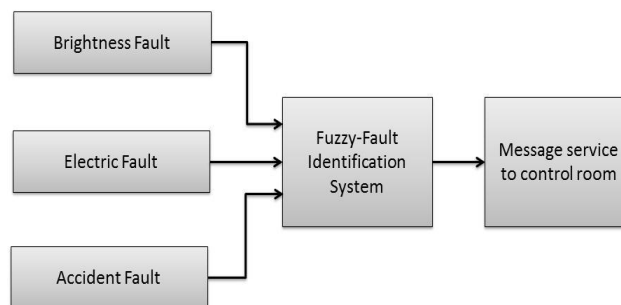

Fig.1. Block diagram of fuzzy-fault identification system

3. WIRELESS SENSOR NETWORK (WSN)

Urban areas witness tremendous increase of vehicular traffic. Traffic management and surveillance by using traditional methods become inefficient in terms of performance, cost and maintenance with the increased traffic. This paper proposed a Wireless Sensor Networks (WSN).

WSN technology has a potential to overcome these difficulties, and will have a great added value to intelligent transportation systems (ITS). Wireless sensor can produce in small size and low cost by developments in embedded Systems and wireless technology. The several advantage of WSN is enabled wireless communication, cheaper and flexibility to overcome existing difficulties of ITS. The exchange of information can be performed either through ad-hoc communication, or using infrastructure, or hybrid. Two types of sensors were distinguished which is on-road sensors and on-vehicle sensors. The result of combination of sensor types and communication paradigms is various wireless sensor network architectures for ITS applications as illustrated in Figure 2. Ad-Hoc paradigm does not have a specific backbone but they exchange and forward collected data in an ad-hoc manner. All the above sub classes in infrastructure enable can be found but with the presence of base stations (BSs) that can be also relayed to each other or to servers and Internet through either wireless or wired links[11].
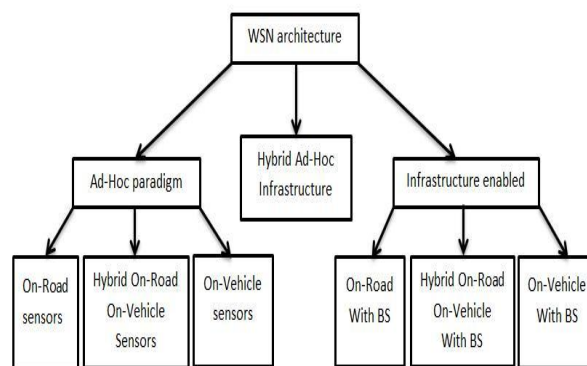

Fig. 2. WSN Architectures for ITS[5]

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4. OVERVIEW ON GSM

GSM is a technology of a digital cellular communication and was applying in many mobile communications especially mobile phones. The sending signal will divide by time to make sure the sending data will arrive at the destination. GSM offer a wide range of transmission and services like voice, data and internet access. GSM is a global standard for wireless communications as well as a cellular technology widely used around the world. GSM modem specifies the command such as: text messaging, calling a given Phone number, deleting memory locations etc. GSM modem is control by computer by using AT-command. Both dial-up modems and GSM modems support a common set of standard AT commands. Its can use a GSM modem just like a dial-up modem. For this project, only AT- command will be implementing because the GSM module just send the SMS to the responsible department [14].

Furthermore, it can connect to the computer by using RS232 serial port to make calls, receive/send messages and deal with other business transactions[7]. GSM modem use wireless network and behaves like dial-up modem. The difference between dial-up modem and wireless modem is dial-up modem use fix telephone line while wireless modem uses radio wave to send and receive data[15]. Like a GSM mobile phone, a GSM modem requires a SIM card from a wireless carrier in order to operate. GSM modem is shown in Figure 2.4.

AT is the abbreviation of Attention and a specific command language. AT-Command used as instruction to control the modem. "AT" or "at" are the starting Command for a line and that why the modem called as AT Command Usually, these command were used to control wired dial-up modem, such as ATD (Dial), ATA (Answer), ATH (Hook control) and ATO (Return to online data state), are also supported by GSM/GPRS modems and mobile phones[6].

Fig. 3. GSM modem[17]

In addition, GSM/GPRS modems and mobile phones support an AT Command set that is specific to the GSM technology, which includes SMS-related commands like AT+CMGS (Send SMS message), AT+CMSS (Send SMS message from storage), AT+CMGL (List SMS messages) and AT+CMGR (Read SMS messages).

5. SHORT MESSAGE SERVICES (SMS)

SMS known as text message services is a communication protocol to exchange short text messages between fixed line or mobile phone devices. The geographical factors and the capability of the technology made the usage of SMS become constraints [8]. This project uses SMS as primary communication mechanism to send a detailed failure. The one reason we choose SMS because it is relatively cheap, costing somewhere from RM 0.01 to RM 0.20 to send a message, and for many plans it is free to receive messages This system will use SMS as a telecommunication field between systems and responsible department. Good urban and rural cellular coverage is becoming the case in much of the developing world. A single short message comprises of words or numbers or an alphanumeric combination can be up to 160 characters or 140 characters of text in length. Non-text Based short messages are also supported[5]. A message SMS is delivery through a Short Message Service Center (SMSC) that is computers within the operator's network that receive the messages and route them to the recipient with some flexibility. The information in traditional SMS service does not provide encryption before its transmitting [9].

6. BLOCK DIAGRAM

Figure 4 shows the block diagram for the system. Based on the block diagram, it shows the microcontroller will take any SMS from GSM modem also update system status through LCD if it gets proper command it will turn on/off street light led through relay and send back acknowledgment to the sender, telling about the current status and location of a street light.
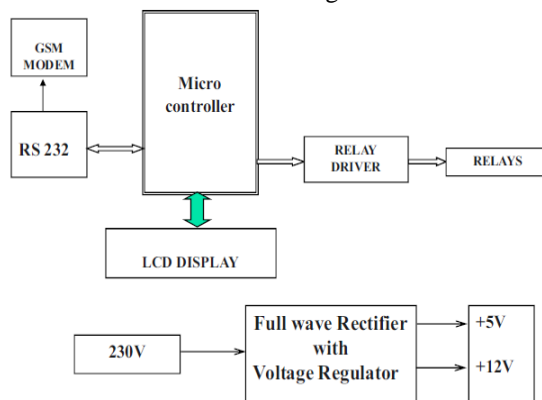

Fig. 4. Functional Block diagram

7. SOFTWARE DEVELOPMENT

For software implementation, Mikro C pro for PIC programming language was used to program the

microcontroller. The flow chart for the system is shown in Figure 5. The microcontroller will initialize when the power supply switch O

As shown in the figure 5, system is started by initializing all hardware and software components like LCD, GSM module, interrupts and all the variables that will be used later. Once initialization is done it will keep waiting for an SMS to come, when SMS is received, first it is processed, by extracting the actual message from the whole SMS, then after the extraction it is checked whether SMS received is in command format like #a1 where # must be send to recognize the message as an command SMS, if command is received then it will extract the actual command in which the second letter represent a specific street light like a, b, c etc and the third one is considered as the status that operator wants for the street light like 1 for on and zero for off. Relays are turns on/off according to the status bit and after that for feedback an acknowledgment SMS is send to the operator to confirm that the specific operation did happened. In the meantime LCD is updated to show the corresponding events.
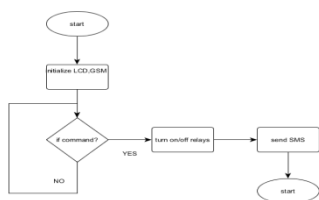

Fig. 5. Flow chart[16]

After this the system again goes to start point where it again waits for another SMS to come. Interrupt methods are used instead of polling to ensure the power consumption and the microcontroller will remain in sleep mode if nothing is happening but as soon as message is received it will jump to the required process finish the job and come again to the sleep mode.

8. RESULT AND DISCUSSION

The test result for hardware and software of the system is shown. The testing was done stage by stage to make sure the hardware and software functions as designed. The testing was divided into two stages: Output unit Testing and SMS unit testing. Then, the discussion was done based on the result of the test.

➢　　　Output unit Testing

This project has output components like LCD and leds which need to be tested to confirm what is going on in the circuit. Test is passed if it gives output as expected i.e. according to the code that we have written[13].

First when system is started, LCD gives the message "waiting for the system to be stable" after which it gives message "initializing…" which indicated that system is in initialization mode. After initialization is done, it gives the message that "system is ready" means that system is ready to receive SMS. All led's that represent street lights should remain off in this process[15].

When SMS is received, LCD will display that specific street light which is turn on/off by showing message like "street light1 is turn on/off", also the corresponding led should change its status according to the status bit. After some time LCD will display message "feedback SMS is sending" to indicate that acknowledgment is sending to the operator. After which it will show "system is ready" message to indicate that microcontroller is again ready for the next SMS to receive.

9. CONCLUSION

As a conclusion, this project is successfully design and tested. Two objectives were figured out in this project after researches about monitoring system of street light and GSM modem have made. Setting up the objectives is the first and the most important task in this project. When the vision of objective was clear, the development of project step takes place. In addition, a review on journal that relevant to the project was done to gain more idea and latest technology implementation. Some journal uses as reference to increase the scope of limitation. The methodology process was conduct after gathering the information. In this process, focuses were given to hardware implementation and software implementation. A detailed hardware implementation gives a good result in term of design and cost consumption. At the same time, the programming design was conducted to make sure the hardware meets the objectives. The next process was testing and data gathering. The testing was conducted stage by stage to monitor result. The result was tabulated and analyzed. Based on result analysis, it shows that the project meet all the objective requirements.

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REFERENCES

[1] Koay, B.K. and M.M. Isa. Traffic light system design on FPGA. In Research and Development (SCOReD), 2009 IEEE Student Conference on. 2009.

[2] Soh, A.C., A.J. Ishak, and M.H. Zaini. Smart monitoring fault detection system for malfunction traffic light operation. In Industrial Electronics and Applications (ICIEA), 2013 8th IEEE Conference on. 2013.

[3] Kafi, M.A., et al., A study of Wireless Sensor Network Architectures and Projects for Traffic Light Monitoring. Procedia Computer Science, 2012. 10(0): p. 543-552.

[4] Ali, M.A.b., TRAFFIC MONITORING AND ENFORCEMENT SYSTEM USING COMPUTER VISION 2010.

[5] Nithya, N. and M. Hemalatha, GSM based cost effective street lighting application. Procedia Engineering, 2012. 30(0): p. 737-741.

[6] NOOR, M.H.B.M., GSM-BASED NOTIFICATION CAR THEFT DETECTION VIA SMS. 2011.

[7] Wanlin, G., et al. Study and Implementation of Agricultural SMS Management System. In Information Technology and Computer Science, 2009. ITCS 2009. International Conference on. 2009.

[8] Firdaus bin Haji Sidek, S. The development of the short messaging service (SMS) application for the school usage. In Information Technology (ITSim), 2010 International Symposium in. 2010.

[9] Saxena, N. and N.S. Chaudhari, EasySMS: A Protocol for End-to-End Secure Transmission of SMS. Information Forensics and Security, IEEE Transactions on, 2014. PP (99): p. 1-1.

[10] Sarik, J. and I. Kymissis. Lab kits using the Arduino prototyping platform. In Frontiers in Education Conference (FIE), 2010 IEEE. 2010.

[11] Teikari, P., et al., An inexpensive Arduino-based LED stimulator system for vision research. Journal of Neuroscience Methods, 2012. 211(2): p. 227-236.

[12] Xiaofeng, L., et al. Innovation for the course of C language to embedded platform. In Education Technology and Computer (ICETC), 2010 2nd International Conference on. 2010.

[13] Hu, Y. Design and Development of C Language Integrated Development Environment with Data Accessing. In Information Technology and Applications (IFITA), 2010 International Forum on. 2010.

[14] Paun, M.A., J. Sallese, and M. Kayal. Temperature considerations on Hall Effect sensors current-related sensitivity behavior. In Electronics, Circuits and Systems (ICECS), 2012 19th IEEE International Conference on. 2012.

[15] Chucheng, X., et al. An overview of integratable current sensor technologies. In Industry Applications Conference, 2003. 38th IAS Annual Meeting. Conference Record of the. 2003.

[16] Alvin, C., et al. Thermal analysis of extruded aluminum fin heat sink for LED cooling application. In Microsystems, Packaging, Assembly and Circuits Technology Conference (IMPACT), 2011 6th International. 2011.

[17] Shih-Chang, H., L. Sheng-Yueh, and C. Jyun-Jia. High-power led dimming driver with multi-level current for smart street lighting system. In Energy Efficient and Green Networking (SSEEGN), 2013 22nd ITC Specialist Seminar on. 2013.