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INTELLIGENT TRAFFIC MONITORING AND SECURITY SYSTEM

COEN- 6711 MICROPROCESSORS AND THEIR APPLICATIONS PROJECT REPORT

Submitted by

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COEN- 6711MICROPROCESSORS AND THEIR APPLICATIONS

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Intelligent Traffic Monitoting and Security System

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Abstract- **In the present scenario, the population is very high and number of vehicles is increasing at an alarming rate. The current solutions to control the high traffic are efficient but they are very expensive, difficult to maintain and there are no automated systems to report the traffic status to emergency (911) systems. So, the current world needs an intelligent traffic monitoring system.**

The main aim of this project is to monitor the traffic intensity of a road segment depending on which the microprocessor takes the decision and reports the traffic status to emergency (911) systems via SMS. The system also displays the status of the traffic in a LCD which will be placed at the entry of the road segment, so that the people can take diversions accordingly depending on their schedule.The Intelligent Traffic Monitoring Systems employs the use of an ARM Cortex M0+ microprocessor; IR Transmitters and Receivers; GSM Module to achieve this goal.

***Keywords*—IR Transmitter and Receiver, GSM Module, Cortex M0+.**

I. INTRODUCTION

Smart traffic management systems have always played an essential part in any smart city network. The Governments have employed these systems almost in all smart cities. These systems are efficient but they are very costly, difficult to maintain and mainly they do not report the status of traffic to emergency (911) systems. Our idea of intelligent traffic monitoring and security systems will report the status of traffic to emergency (911) systems. With the implementation of this feature fire engines and ambulances can plan their routes to the destination on a prior hand and can reach the place where help is required on time without any delay. The introduction of this idea can result into less traffic, more security and happier citizens.

People enter into a road without knowing the status of traffic on that particular road. This project implements the idea of alerting the people about the intensity of traffic in a particular road segment. This information will be displayed on a LCD which will be placed at the entrance of the road segment. On seeing the status of traffic intensity people can take diversions accordingly and reach their destination safely without any rush.

The proposed solution will monitor the traffic and provide updates which will achieve the following goals:

i. Updates to the emergency (911) systems on traffic so that they can change the route accordingly.

ii. Display the traffic status of the road at its entrance so that people entering that road segment can take diversions depending on their schedule.

II. SYSTEM DESIGN ANDREQUIREMENTS

After the proposal of the idea, the team came up with the following system design and requirements to implement the system that will achieve the above mentioned goals.

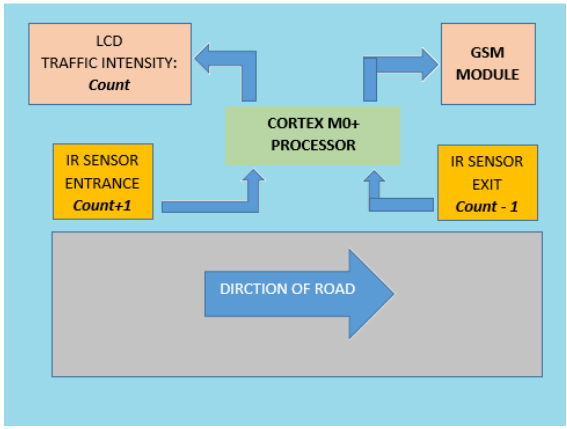

Fig. 1. System Design of Intelligent Traffic Monitoring and Security System

i. Counter should increment whenever the IR sensor placed at the entrance of the road detects a vehicle.

ii. Counter should decrement whenever the IR sensor places at the exit of the road detects a vehicle.

iii. The processor should monitor the value of counter.

iv. If the value of counter is greater than five more than two minutes the system should alert the emergency (911) systems by sending SMS through GSM Module.

v. The system should display the value of counter on LCD whenever the value of the counter gets updated.

III. HARDWARE COMPONENTS

A. *IR Obstacle Detection Module:*

In the Intelligent Traffic Monitoring and Security Systems we have used the Infrared Obstacle Detection Module. The Module has an IR Emitter LED, IR Receiver and Distance adjust button. The following diagram shows the parts of the module

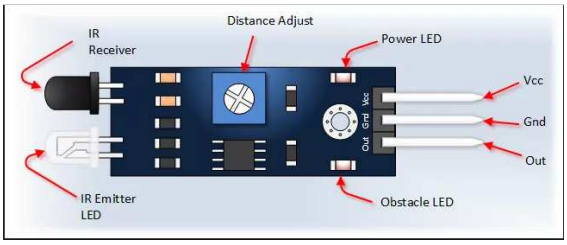

Fig. 2. Parts of the IR Obstacle Detection Module.

The IR LED Emitter will emit the IR radiations with the intensity depending on the distance set using the distance adjust. When the IR radiations hits an object, they get reflected. The IR Receiver receives the reflected radiation and it will set the out pin to high. If the receiver doesn't receive any reflected radiation then the out pin will be set to low.

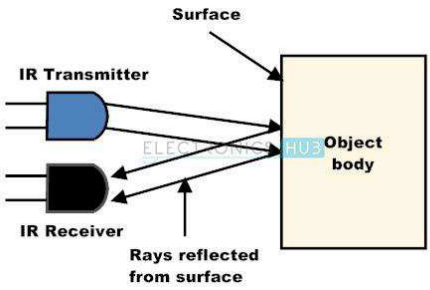

Fig. 3. Working of IR Obstacle Detection Module.

For the purpose of detection of obstacle there are lot of other sensors available. By considering our budget and ease to implement we have chosen the IR Obstacle Detection Module.

B. *Display Module:*

The Intelligent Traffic Monitoring and Security System employs a 16*2 LCD Display Module to display the Traffic Intensity.

Fig. 4. LCD Display Module.

C. *GSM Module:*

The Intelligent Traffic Monitoring and Security System employs a GSM Module for the purpose of sending SMS alert about the traffic intensity to the emergency (911) systems. GSM is a mobile communication modem; it is stands for global system for mobile communication (GSM). It is widely used mobile communication system in the world. GSM is an open and digital cellular technology used for transmitting mobile voice and data services operates at the 850MHz, 900MHz, 1800MHz and 1900MHz frequency bands. A GSM modem is a device which can be either a mobile phone or a modem device which can be used to make a computer or any other processor communicate over a network. A GSM modem requires a SIM card to be operated and operates over a network range subscribed by the network operator. It can be connected to a computer through serial, USB or Bluetooth connection.

In this system, the processor will monitor the traffic count. If the count is greater than five then the processor sends "AT" command (used to send SMS using GSM Module) to GSM Module. Upon receiving the command the GSM Module will send the SMS alert with traffic status to the emergency (911) systems.

Fig. 5. GSM Module – SIM 800c.

D. *Processing Unit:*

The FRDM-KL25Z is the development board with ARM Cortex M0+ process is the processing unit employed in this project.The Freedom KL25Z is an ultra-low-cost development platform for Kinetis® L Series KL1x (KL14/15) and KL2x (KL24/25) MCUs built on Arm® Cortex®-M0+ processor.

This FRDM board is interfaced with the IR Sensors, LCD Module and the GSM Module and it acts as the brain of the system. The processor receives the value of count from the IR sensors and then depending on the count it decides whether the GSM Module should send alert or not. The processor also commands the LCD to display the Traffic intensity on it.

Fig. 6. FRDM-KL25Z.

IV. SOFTWARE

A. *MBED online compiler:*

The FRDM-KL25Z has been designed by NXP in collaboration with mbed for prototyping all sorts of devices, especially those requiring the size and price point offered by Cortex-M0+ and the power of USB Host and Device.

We are implementing the software of the system with the help of mbed online compiler as our board supports that. The other reasons for choosing the mbed online compiler is that it is very easy to use and it has a lot of library files that will reduce the effort spent for programming. After the code has been compiled without any errors, a bin file is generated which has to copied and pasted into the drive that appears after connecting the FRDM board to the pc. This reduces the effort spent towards setting up the JTAG and debug settings as in the case of Keil.

V. IMPLEMENTATION

The working of the system can be explained with the help of the following flow charts. When the IR Sensor at the entrance of the road detects a vehicle, the processor increments the value of the counter.

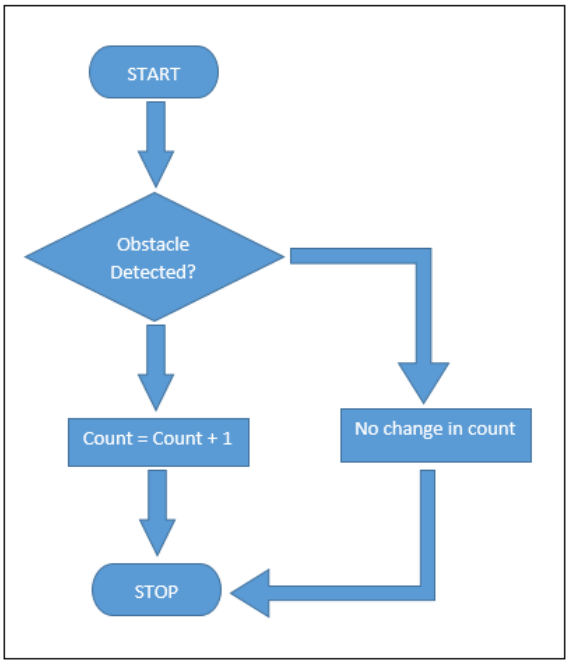

Fig. 7. Flow Chart – IR Sensor at Entrance of the road.

When the IR Sensor at the exit of the road detects a vehicle, the processor decrements the value of the counter.

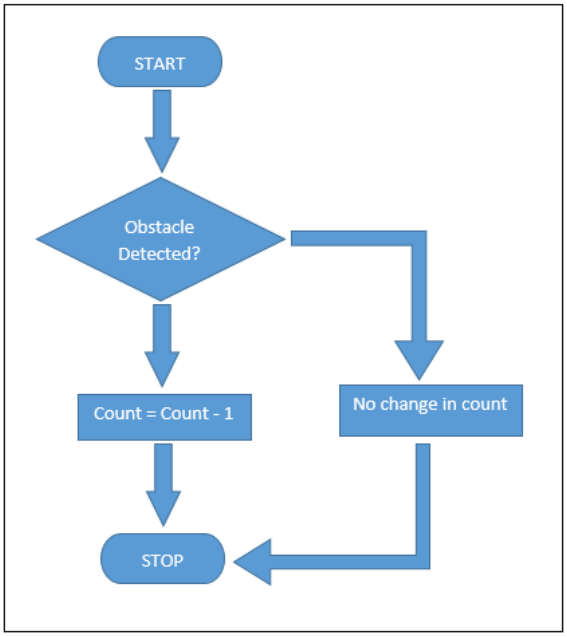

Fig. 8. Flow Chart – IR Sensor at Exit of the road.

The processor checks if the value of counter is greater than five for more than two minutes. If the value of counter is greater than five for more than two minutes then the processor will send command to GSM Module to send the SMS alert to emergency (911) systems.

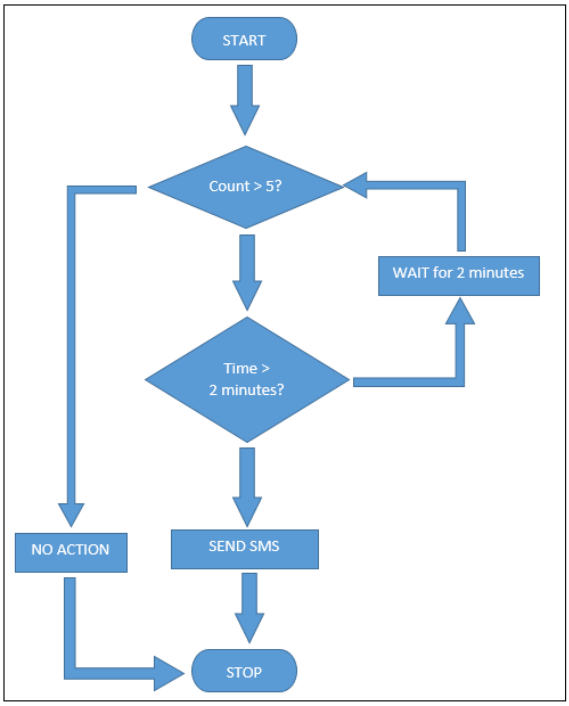

Fig. 9. Flow Chart – GSM Module.

The Processor will display the value of the count on the LCD whenever the value gets updated. The code of the system is present in appendix - A.

VI. TESTING

To verify the proper functioning of the system we performed the following tests:

1. Software Unit Test: To ensure the proper functioning of each piece of code is working fine. We separately tested whether the value of count variable in code gets incremented or decremented depending on the inputs from IR sensors at entrance and exit and whether the GSM Module sends SMS alert properly when the value of the count variable exceeds the limit.
2. System Test: We did a testing at system level (the final product which includes both software and hardware) to ensure that the integrations of all the functions work properly without any error.
3. Regression Test: We did regression testing every time when there was an update in code or change in hardware connections. This was done to ensure that the modifications does not affect the system behavior.

VII. FUTURE SCOPE

The Intelligent Traffic Monitoring and Security systems can extend their scope of application by employing RFID and enable smart parking and security systems.

Each vehicle can be provided with a unique RFID tag. RFID sensors can be placed at the entry at entrance and the exit of the road. With this we can also monitor whether the vehicles entered the road have exit or not. If the RFID sensor at the exit of the road has not detected the RFID of the vehicle entered then the processor will identify that the vehicle has been parked somewhere in the road. If the vehicle has been parked in the road then the processor with the help of RFID information will access the database and finds whether the person owning the vehicle has paid the parking fee or not. If the parking fee has not been paid then the processor will send an alert to the nearby police station so that they can take the necessary actions. With the help of RFID we can also record the data (such as vehicle number, time and date) of vehicles entering and leaving the road. This information can be used efficiently in case of investigations and emergency situations.

VIII. CONCLUSION

The main objective of this project is to implement an Intelligent Traffic Monitoring and Security System that will send SMS alert on the traffic intensity to the emergency (911) systems to help the ambulance drivers and fire engine drivers to choose their route and reach their destination on time without any delay. This project demonstrates successful implementation of the proposed requirements to achieve the proposed goals.

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