

AI Traffic signal controller

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Abstract - Today's traffic light system has a lot of limitations at road intersections. The system is not flexible or in other words cannot adapt on real time. The traffic light has fixed timing for the three traffic lights "green, yellow and red". The vehicles waste a lot of fuel and surely the driver waste a lot of time. To solve 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, AI camera 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.

Index Terms – Traffic Light, Traffic Management, Emergency response

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 colour 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 implementing AI camera on the traffic light 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 AI camera detects vehicles. To detect the emergency vehicles, The GSM modem will be used to receive signal from traffic in charge 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 AI camera and GSM system to provide users with smart and less traffic roads.

II. 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 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) \propto 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) \propto 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) \propto Duration for settling the accident (A) (3)

III. SYSTEM COMPONENTS

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 (1) GSM-III alarm base system

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.

Traffic lights:

Three different colour lamps are used (RED, ORANGE, GREEN).

ATMEGA 32 microcontroller:

It is programmed to perform the tasks in the system.

IV. ALGORITHMS

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.

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.

Table (1) Traffic timing versus traffic density

Traffic density (D)	Emergency cars	accidents	Timing (TN) secs.
6	NON	NON	30
7	NON	NON	32
8	NON	NON	34
9	NON	NON	36
10	NON	NON	38
11	NON	NON	40
12	NON	NON	42
14	NON	NON	44
15	NON	NON	46

VI. CONCLUSION

The number of road's users is constantly increasing; 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 emergency car is thought to be beneficial to both environment and economy.

REFERENCE

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