# Design Of Semi-Automatic Traffic Light Control System

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**Abstract**—Today's traffic light system has a lot of limitations at road junction. The system is not flexible or in other words cannot modify on real time . The static traffic control have fixed timing for the three traffic lights "the green , yellow and red ".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.

**Index Terms**—control system , PC , Bascom , traffic, microcontroller ,GSM system.  Traffic light

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## 1   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.
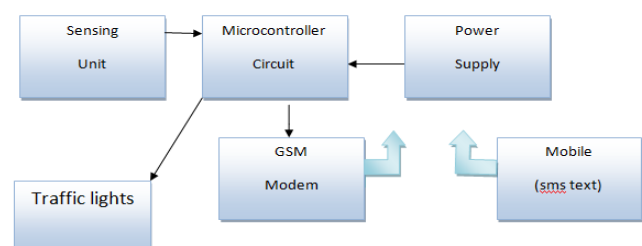The figure (1) below shows the block diagram for the system.

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**Figure (1)** Block diagram of the system design

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 collector-current 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.

**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 |

## 6  VI.  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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