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Traffic light automatic design

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Abstract: A lot of challenges and limitations at road junction in the traffic light system has. In real life the systems are based on static mode of programming the traffic lights. Therefore, it is not flexible or in other words cannot modify on real time . Hence, the vehicles waste a lot of fuel and surely the drivers wastes a lot of their 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, computer and the GSM modem which could add the real time benefit to the system. This paper explores the design for the automation of the traffic light control system. The traffic light is designed using a personnel computer (PC) programmed in C++ language, IR sensor and GSM modem.
The system solves the wasting time and fuel problem .The system also considers the problem of the emergency vehicle which waits a lot in the road intersection . The design considers as well the problem of the congestion that occurs when an accident in the path happens.

Keywords: - *control system , PC , C++ , traffic, GSM system*

I. INTRODUCTION

The Traffic Light Controllers are based on a variety of electronic technologies. 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 vehicles waste a lot of fuel.

The aim of the driver is to reach at the destination without wasting time and fuel. 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 all over the world 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 using an 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 the personnel computer in the system is to provide a programmable process and an interfacing to the external devices. In the proposed design the personnel computer will be the master of the system . 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 microprocessor.

The IR sensor detects vehicles and also detects the emergency vehicles. It is interfaced to the computer through the parallel port .The program in the PC polls the IR sensor periodically and accordingly responds. In this paper, intelligent traffic light controller based on the personnel computer is implemented using the IR sensor and GSM system to provide users who wish to obtain the latest status of traffic on congested roads.

II. APPROACH

The paper covers the area of microprocessor based system , data acquisition , interfacing and wireless data exchange .
The system design method will be divided into three parts as follows :

- Part one : the sensing unit.
- Part two : control algorithm .
- Part three : GSM model.

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

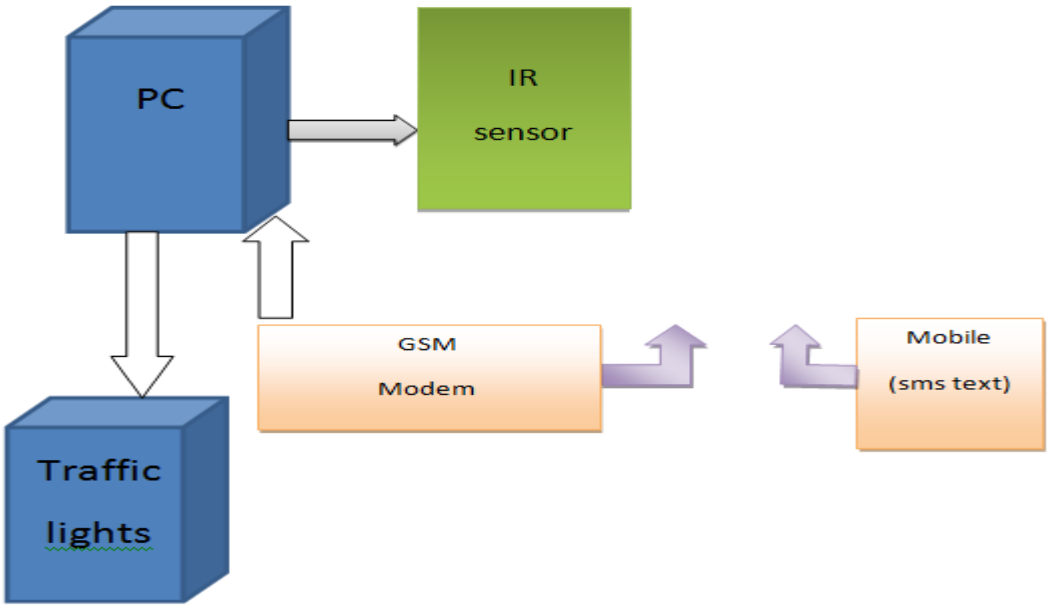

Figure (1) Block diagram of the system design

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 vehicles 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 vehicles 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)

III. SYSTEM COMPONENTS

1. . The GSM system :
The GSM-III alarm base system is interfaced to the personnel computer . It sends and receives SMS messages .The GSM provides the personnel computer with the commands and accordingly gives response based on the program. Figure (2) shows the GSM-III alarm base system.

2.Personnel computer (PC):
PC computer is used as the master controller of the system.. The C++ language is used to program the personnel computer.

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.

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.
5. Traffic lights :
Three different colour lamps are used (RED , ORANGE , GREEN).

IV. ALGORITHM

The personnel computer 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 vehicles 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 make the priority always to the emergencies vehicle is thought to be beneficial to both environment and economy.

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