KANTIPUR ENGINEERING COLLEGE

DHAPAKHEL, LALITPUR

(AFFILIATED TO TRIBHUVAN UNIVERSITY)

A PROJECT PROPOSAL ON:

"DENSITY BASED AUTOMATIC TRAFFIC LIGHT CONTROL SYSTEM"

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CHAPTER 1: INTRODUCTION

This project "Density Based Automatic Traffic Light Control System" is based on the area covered by the vehicles and their density at their junctions to control the traffic lights. An IR Transmitter and IR Receiver is used to detect the density, speed and flow. The IR counts the vehicles and density on the road and Microcontroller atmega328/p generates the results.

Smart Traffic is a Video Analytics Module and provides Traffic Incident Detection, and real time Traffic Flow Metrics & statistical analysis. Smart Traffic Monitoring can integrate with third party traffic management and smart roadway systems and hosts a feature rich product scope itself. The system can be used for incident detection or for statistical metrics of a roadway.

1.1.   General Background

Street lights are controlled manually in olden days. These days automation of street lights has emerged. But one can observe that there is no need of high intensity in peak hours i.e. when there is no traffic and even in early mornings. By reducing the intensity in these times, energy can be saved to some extent.

AVR 32-bit microcontroller is based on the RISC microcontroller architecture and is produced by Atmel. It has a large number of registers and built in features and consumes very low power which makes it ideal for use in embedded systems.

Smart Traffic Management is mainly improvised for looking after the Set off data of a region to manage the Traffic along that area and implement various useful technologies which are been required by various persons like vehicle owners, pedestrians, police officers. Mainly the purpose of Smart traffic management system is to give the details which can be used and they can be implemented in their daily life. The problems which have been occurred at their presence can be solved by this Smart Traffic.

1.2.   Rationale

Now a days the use of vehicles is maximum, it has resulted in losing millions of money and time every hour. Traffic congestion is caused by many factors. One of the factors is the current traffic controller cannot accommodate the variety of traffic volume. In our country the traffic control system is mostly based on sequential logic. There are three lights red for stop, yellow for get ready and green for go. Each light operates for a given period one after the other. The programming is so done that two lanes won't have the green light at the same time. The traffic control system at a certain places are even controlled manually by traffic personnel but human error calls for automation to prevent undesirable incidents on road. The traffic signals control the vehicle movements. They are connected to electronics system which control the signals. A pre-timed and coordinated traffic controller system can be implemented based on an ATmega microcontroller. Controller cannot accommodate the variety of traffic volume. A pre-timed and coordinated traffic controller system can be implemented based on an ATmega128A microcontroller. A pre-timed and coordinated traffic controller system can be implemented based on an ATmega128A microcontroller

1.3.   Objectives

1. Provide for orderly movement of traffic.
2. Increase capacity at intersection.
3. Reduce frequency and severity of certain kind of clashes.
4. Provide continuous movement of traffic at a desired speed.

1.3. Features

1. The system work with AVR family Microcontroller that is interfaced with the IR sensors and photodiodes aligned in line of sight configuration across the load for detecting the density.
2. The density is calculated in three ways such as low, medium and high according to timings are allotted for signals.
3. The system featured with a control panel that overrides the signal timings by immediately giving green signal in the vehicle direction like ambulances and fire trucks and red signal for all other.
4. The control panel can also be used to control the traffic lights manually in case of road accidents.

1.4. Feasibility

1.4.1. Technical Feasibility

Real time based controllers are among the most fundamental traffic signal system components. These controllers operate by using programmed cycle lengths and time of day operations to manage traffic at junctions. The main component used for the expected system consist of a Microcontroller (Atmega 328/p), IR Transmitter and IR receiver. All the components are easily available in local Electronics Market and College. Traffic signal controllers and detection devices are incorporated into a variety of different arrangements in order to accommodate the needs of each roadway junctions.

1.4.2. Economic Feasibility

The main components used for the expected system are easily available in local electronics market and inside college and the cost of all the components are reasonably cheap.

CHAPTER 2: LITERATURE REVIEW

2.1. Literature Review

Traffic signal systems have been implemented since the early twentieth century as a process of continuously managing traffic flow and for smooth and safe automobile transportation. Due to the continuous increase of vehicles in urban areas, there is a need for further evaluation and implementation of traffic signal systems.

Density, speed, and flow are the three critical parameters for road traffic analysis. For a high performance real time traffic management analysis and control require estimation of mean speed effective area and density of space is needed. The position and speed from the vehicles is utilize to optimize the traffic control

The smart Traffic light is implemented in various countries such as Indonesia, China, USA and soon which is commercially made by Surtrac based on the research done by Carnegie Mellon University. The project has been attempted by the past students of KEC but controlling the traffic using density hasn't been done yet. The research and study of smart traffic control is being carried out by National Institute of Technology and IIT based on PLC and cement based piezoelectric sensor for real time application. The research system specifies the use of onboard sensors in vehicles and standard wireless communication protocol specified for vehicular applications by implementing various traffic signal Control Algorithm. By integrating ITS into its traffic signal system, the city of Seattle, Washington, has witnessed notable improvements to both motor vehicle flow and capacity. Through a combination of loop detectors and traffic signals as illustrated in Figure 3, Interstate 5 in Seattle has improved rush hour capacity by 10% to 100% while also

increasing highway speeds. Additionally, the accident rate was reduced by 39%. Table 3 confirms that other cities have seen similar benefits from this method of metering freeway entrance ramps.

The expected system contains IR Transmitter and IR Receiver. IR counts the vehicles and density on the road and Microcontroller atmega328p generates the result. Density based Signal Management in Traffic System shows how traffic light signal control, including with the implement of Traffic Scheduling Algorithm which gains information of the vehicles speed and position. If the density of the road traffic is high then Maximum density of traffic will allow maximum default timing for traffic lights. Minimum density of traffic will allow traffic with minimum timing for traffic lights. If the traffic rate on both side is Equal or gap within traffic then according to arrival time traffic light signal set to minimized. The system also proposes the Priority Based traffic light signaling which help to assign the priority to the lanes with highest traffic density as per demand in order to control the traffic smoothly. When there is an emergency situation like ambulance, fire brigade stuck in traffic, accident then the system is switched to manual mode. The density is measured in three ways low, medium and high according to which the timings are allotted for signals. The timing overridden is done using Bluetooth technology in android device or by manual controller. When the traffic density increase more than a limit at one particular side, it needs a longer green light duration to ease traffic flow. The system uses a microcontroller that is interfaced with IR sensors. These IR sensors are used for line of sight object detection using which the system gets an input of the traffic density. Traffic density is measured as "low, medium and high". Based on this density reading the system adjusts and varies the traffic signal duration for that particular way.

CHAPTER 3: SYSTEM REQUIREMENT

3.1. Hardware Requirement

3.1.1. AVR Microcontroller

The AVR is a modified Harvard architecture 8-bit RISC single-chip microcontroller. The AVR was one of the first microcontroller families to use on-chip flash memory for program storage, as opposed to one-time programmable ROM,EPROM, or EEPROM used by other microcontrollers at the time. The main heart of this traffic system is microcontroller. The smart traffic light management system is controlled by using Atmega328p because it is easy to program, sufficient number of input output lines, manageable size of RAM and ROM and simple architecture. System program and application program are stored using RAM and ROM. It determines traffic on each road based on sensor's value.

3.1.2. Sensor

i.   IR Transmitter

IR transmitter looks like an LED. This IR transmitter always emits IR rays from it. The operating voltage of this IR transmitter is 2 to 3v. These IR (infra-red) rays are invisible to the human eye. But we can view these IR rays through camera. The IR pair are placed in such a way that when an obstacle is in front of this IR pair, IR receiver should be able to receive the IR rays. When the power is supplied, the transmitted IR rays hit the object and reflect back to the IR receiver.

ii.   IR Receiver

IR receiver receives IR rays that are transmitted by IR transmitter. Normally IR receiver has high resistance in order of mega ohms, when it is receiving IR rays the resistance is very low. The operating voltage of IR receiver also 2 to 3V. On each

road IR transmitter is placed which detect the vehicle and give current traffic information on each road to the IR receiver.

3.1.3. Basic components

Instead of traffic lights, The LEDs (RED, GREEN, YELLOW) can be used. In normal traffic system, the LEDs are turned on on time basis. If the traffic density is high on any particular path, then glows green LED of that particular path and glows the red LEDs for remaining paths. Basic hardware components are

- PCB board
- Voltage Regulator
- Serial cable
- Connecting wires
- Oscillator

3.2. Software Requirement

3.2.1. Proteus

The Proteus Design Suite is an Electronic Design Automation (EDA) tool including schematic capture, simulation and PCB Layout modules. It is a CAD Design software used for Schematic Capture, Microcontroller Simulation and PCB Design. Before hardware implementation, the whole circuit is simulated in this Cad designing software and based on the result the product is made.

3.2.2. Atmel studio

Atmel Studio is the integrated development platform (IDP) for developing and debugging Atmel® SMART ARM®-based and Atmel AVR® microcontroller (MCU) applications. Studio supports all AVR and Atmel SMART MCUs. The Atmel Studio IDP gives a seamless and easy-to-use environment to write, build and debug the applications written in C/C++ or assembly code. It also connects

seamlessly to Atmel debuggers and development kits. Atmel Studio can also able seamlessly import your Arduino sketches as C++ projects, providing a simple transition path from Maker space to Marketplace.

CHAPTER 4: METHODOLOGY

The basic concept is to make use of the IR LEDS to send the infrared light waves to the object so that it can detect its presence and also calculate the total area occupied. Another IR diode of the same type is used to detect the reflected waves from the incident objects. The use of the IR sensors can detect the density of the vehicles on the road that can be used to detect the total area occupied by the traffic on the specific path. The signals that are generated from the sensor are applied to the input switching circuits. These input signals generated are in digital form that indicate the presence of absence of the vehicles. These digital signals from each road will be given to the input port of the microcontroller, where the microcontroller will determine the density of the vehicles at each. Then the microcontroller decides the road where the traffic light signal should be green. The continuous comparison of the density of the vehicles makes the whole system intelligent than the present time based systems.
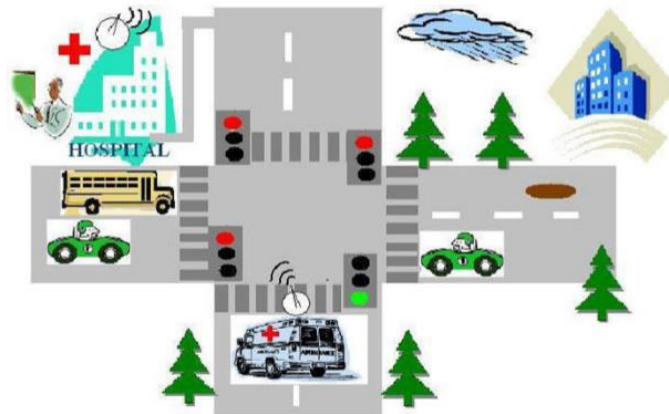
Figure 1: Simple model of the system in operation

The system is also capable of the manual override and emergency response when certain emergency occurs. The automatic system can be manually controlled too. If the accident occurs the central control body (i.e. traffic headquarters) can manually control the system. The central can also monitor the system by the means of the camera interfaced on the system in cases of the accident and emergency conditions the camera has its vital role in the classification of the victims and the cause so that the road accidents can be reduced. The system is fully automatic and intelligent so the system requires less manpower. This is how the system is mainly works.
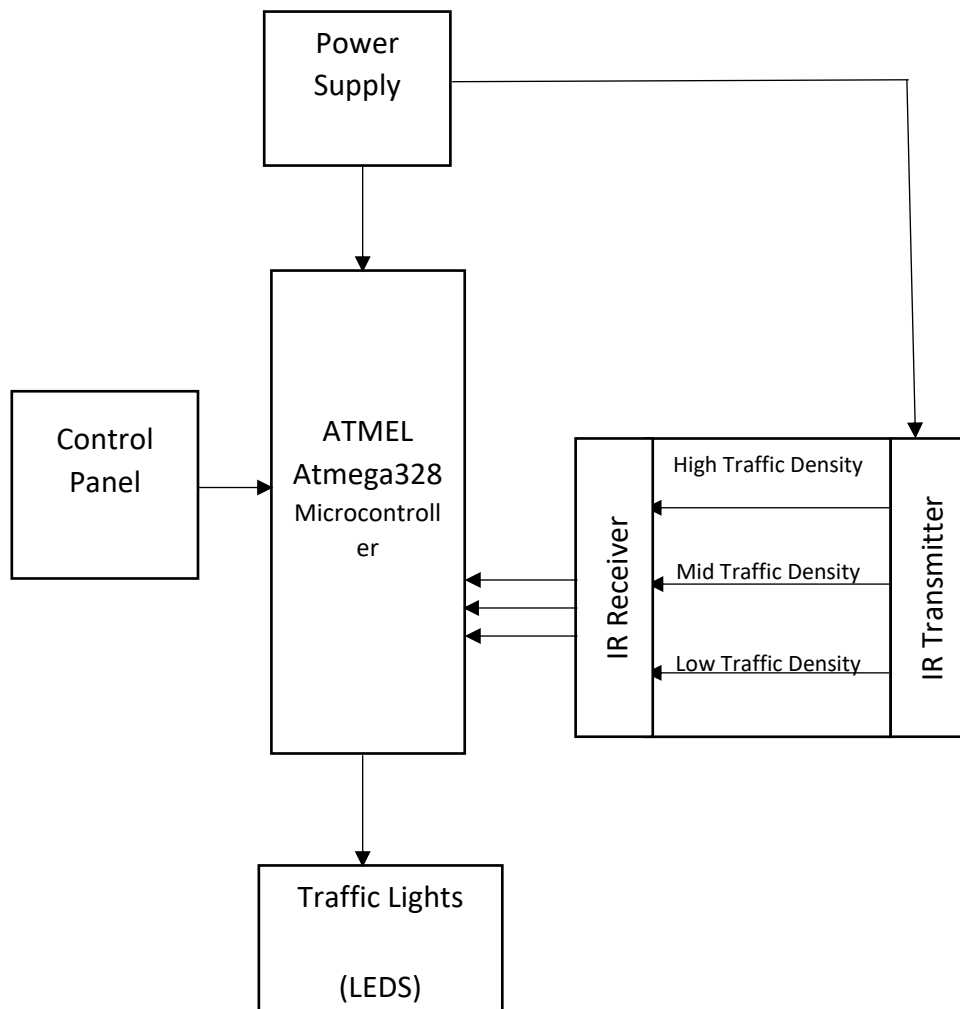
4.1. Hardware Development

Figure 2: Block Diagram of System

4.2. Project Plan

4.2.1. Schedule

Table 1: Work Schedule

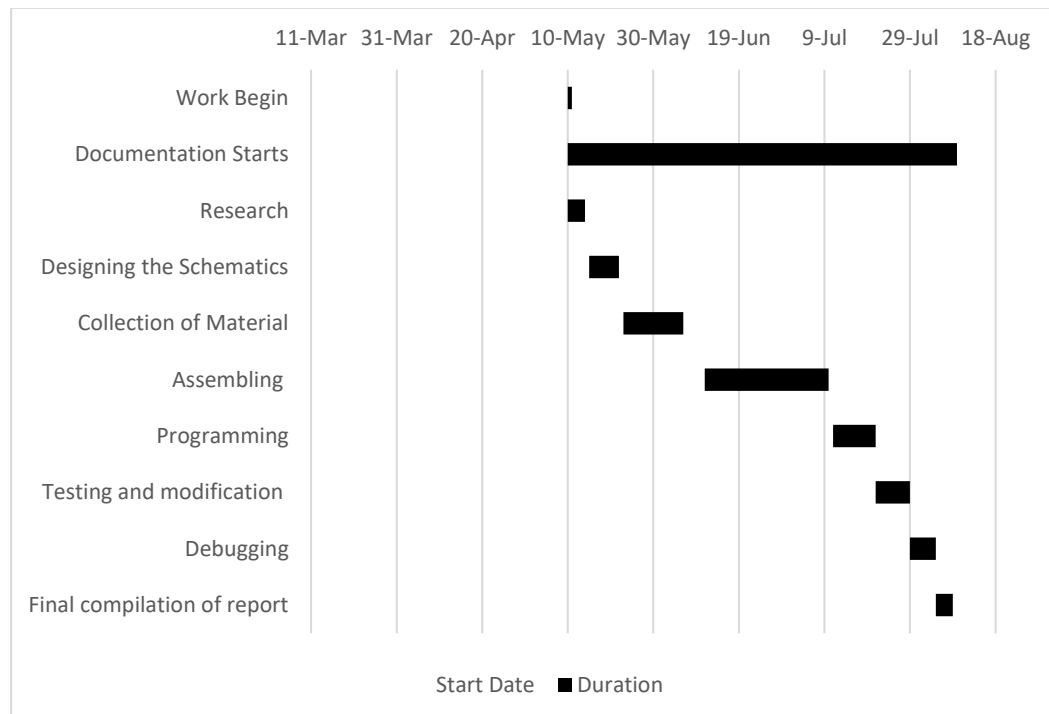| *Work*	*Date*
Documentation	Throughout the project
Research	10 – 14 May, 2016
Designing the Schematics	15 – 22 May, 2016
Collection of Hardware	23 May – 10 June, 2016
Assembling	11 June – 10 July , 2016
Programming	11 – 20 July, 2016
Testing and modification	21 – 28 July,2016
Debugging	29 July – 3 August, 2016

4.2.2. Gantt Chart

Figure 3: Gantt chart

4.3. Cost Estimation

With some relevant assumptions, previous trends and market analysis, we have estimated the cost of the components required for "Density based Automatic traffic light control system" as:

Table 2: Cost Estimation

S.N	Components	Quantity	Unit Price(RS)	Net Price(RS)
1.	ATmega328p	1	800	800
2.	IR sensors	20	35	700
3.	Oscillator	2	150	300
4.	PCB board	1	200	200
5.	Resistors, Capacitors, Transistors, LED's	-	-	1500
6.	Voltage regulator	1	1	1500
7.	ICPS , Buttons, Switches	-	-	1500
8.	Total			6500

CHAPTER 5: EPILOGUE

The Project "Density Based Automatic Traffic Light Control System" is expected to manage the traffic control with less manpower via controlling the traffic light using an Infrared light and a Microcontroller. The project is capable of detecting the traffic density and automatically controlling of the traffic. The signal is transmitted and receiver by using an IR transmitter and an IR receiver.

5.1. Application

- For smooth traffic control at urban areas.
- To reduced manpower for controlling traffic
- To reduce road accidents.

5.2. Expected Outputs

- Communication between two IR Transmitter and IR Receiver.
- System should be capable of detecting traffic density.
- System should change the direction of the Traffic smoothly
- System should be capable to override to manual mode.

CHAPTER 6: REFERENCES

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