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THERMAL BASED INTELLIGENT TRAFFIC LIGHT CONTROL SYSTEM

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ABSTRACT

Now a days it became very difficult to control the road traffic because of heavy movement of the vehicles in cities. Especially in cities with large population it became tedious job for the traffic police to control the vehicles in countries like India. In the present days even the automatic control systems are not meeting the present day's road commuter traffic density. In the present paper an idea of thermal based technology is described to monitor the traffic density. A Thermal imager principle is discussed in this paper in identification of thermal objects. Accordingly the intelligent traffic system can take appropriate decision in critical situations to avoid bottleneck on road. So that some critical circumstances can be circumvented before it became too late. In the present paper sensor architecture on the road is presented and detail operation of each block is discussed.

KEYWORDS: *Environmental sensors, Simulation, Traffic Light Control, Intelligent System, Thermal imager*

I. INTRODUCTION

The need for large-scale persistent traffic monitoring system has become predominantly significant in recent times after a set of serious accidents, damages to children and old people.It may include like permanent damages, partial damages or my cause a life. Sometimes it is the basic responsibility to observe and take necessary foot steps to control the environment pollution like air pollution, sound pollution on road traffic. The motivations and challenges are taken into consideration by the following work [13][14];

In the present world people are most acquainted with smart environment. Now a days, sensors are incorporated in almost fields like buildings, parks, commercial houses, road traffic, air traffic, ship boards and various other transport media. So it is better to say smart sensor environment rather than smart environment. It needs wide variety of knowledge about sensors and its interfacing with intelligent system. Sensor networks incorporate technologies fromthree different research areas: sensing, communication,and computing [1].It is very important to select appropriate sensor as per the physical parameter present at the field. Once the data is collected it is very important to send the data to digital system without any loss. Once the data is communicated with the intelligent system computing must be done using optimistic algorithms to control final control elements like control valves and traffic lights on the road. Within the field of environmentalsensor networks, domain knowledge isan essential fourth component[2].

The smart environment needs information about its surroundings as well as about its internal workings [3]. There are some situations like in some busy centres; some road directions are congested with heavy traffic density. It is very important to clear the direction having more vehicle density at the same time it is needed to consider the maximum waiting list vehicles queue. Thermal sensors can be used to identify traffic density and to analyse the situation. Thermal sensors and IR sensors can be used at pedestrians to recognize children, to make them walk in save manner. In some situations Flash detectors can be used to detect ambulance, so that the intelligent traffic system can take decision to clear the ambulance path first. In some cases, on two sides the traffic density is almost similar then, the path waiting with larger time allowed first. The waiting time can be measured using timers. And the decision can also be taken based on pollution check. This way in which pollution grade is more needs to be clear first. Carbon monoxide sensing devises can receive and transmit these signals to sensor server located nearer to the field. Detail hardware operations are discussed in the Hardware section. Different types of operations and their functionality in the present section is discussed in the hardware sections. The measurement techniques and their limits and constraints are discussed in the next section. The port bits are shown and discussed in the hardware section. Some of the traffic conditions, simulating techniques and software details are presented in simulation section. Colour full output screen shots of the traffic signals on the road are shown in the third section.

II. HARDWARE

To understand and analyse the traffic hazard signals like, traffic signals, sound detectors, gas sensors signals, it is highly required sophisticated, accurate sensing and digital systems to process and store the data. A key feature of environmental monitoring is the measurement of related environmental variables, being physical, or chemical. Most physical variables, such as temperature, pressure, and light intensity, can be easily measured with portable off-the-shelf sensors. Installation of these sensors is very easy.

Thermal sensors are required to observe the vehicle troops and number of individuals stagnant and travelling on road before the traffic signal. Light detectors are used to recognise time of the day and night. Light sensors are also used to identify some important commuter like ambulance, police vehicles and other important vehicles which are specially connected with flash light. In the present work a prototype is developed to simulate the real world. Small range sensors are selected to design the prototype. But in the real life a large range sensors need to be selected to read data from various directions.For real time application a more sophisticated sensors with high range are required to identify all types of vehicles.Gas sensors are used to detect oxygen percentage and to quantify the release of carbon percentage. Good programming techniques are implemented in Object Oriented programming environment to read data from different sensors placed at different positions.

A prototype is developed with an acousticranging unit [11] and with one infrared camera. In the present system thermal imager and infrared detectors are integrated remotely. The performance of the acoustic system cannot produce accurate results when an obstacle present in “Line Of Sight” (LOS) [9].Acoustic range measurements in obstructed conditionsoften consistently detect longer reflected paths, leadingto unbounded range error. Because they measure the long path consistently, it can be very difficult to identifythese errors based exclusively on analysis of acousticdata [9].Any rangingunit that the camera can see has a high probability ofLOS to the camera, and thus in those cases, an accuraterange can be determined with acoustics. Additionally,using angular displacement, a camera can estimate the range between any two ranging units in its field of view.Additionally, in a more complex scenario, two cameras can be used to coordinate to formulate a 3D model of the object on the road [12].

An infrared camera is a device that forms an image using infrared radiation. These cameras measure the infrared energy emitted by surfaces. The Infrared energy emitted by the object is focused on to an infrared detector. The basic principle of IR camera is when an Infrared energy emitted by the object is related to the temperature of the object. The Thermal Imager converts this infrared energy into a heat picture which is called as thermogram. Different temperatures in the thermogram represented with different colours. The distribution of temperature on the object gives the user a full picture of the object. In the present system a code is developed to detect only the thermal image of an object. In response to this the object is displayed as a point or collection pixel between small coordinates on the monitor. Theses collection of pixels indirectly represents the object presence as shown in figure 5. As in the present design the density of the objects are considered important only object position is identified. And applying good image processing techniques full images can be captured on to the display panel.

Once the signals are captured and converted into digital signals at hazardous unit, these signals are need to be sent control room using RF waves. RF waves are best suitable waves for outdoor signal transmission. On contrast IR waves are used for indoor signal transmission [5]. Because IR range is small, and limited to one closed room. On the other hand, the same technique cannot be applied using RF wave for indoor environments, because RF propagationin indoor environments suffers from severe multipatheffects, which make it impossible to limit the RF range to beexactly within a room. An important characteristic of radio propagation is the increased attenuation of the radio signal as the distance between the transmitter and receiver increases. Radio propagation models [7] in various environments have been well researched and have traditionally focused on predicting the average received signal strength at a given distance from the transmitter (large scale propagation models), as well as the variability of the signal strength in close spatial proximity to a location (small scale models).

In some situations it is highly essential to integrate some traffic signal points to maintain tight security. For monitoring of the previous signal points and other environment quantities along withthe detection, classification, and tracking of living organisms in their environments large data requirements at a global scale, remote-sensingsatellites[4] need to be used.While at the regional scale, fixedmonitoring stations are mainly employed. At the local scale, manualand automated Data Acquisition System process is conducted. In the present work regional scale is simulated in the laboratory.

Thermopiles can be used to measure solar radiation, Sound navigation and ranging (SONAR) and light detection sensors can be used to measure distance of vehicle. MOX and NDIR gas sensors can be used to detect air pollution.

A large data scales need to be measured in order to come across accurate results. Most precise results are highly essential in intelligent systems to make them active in crucial conditions and must be able to take more accurate decisions to avoid accidents and miss interpretations. Accurate measurements can be achieved by maintaining processing time more precisely. This is achieved by good synchronization techniques. There are various techniques effectively involved to synchronize the measure-end with digital acquisition system. Digital pipeline techniques[6] are integrated in simulated circuit to get accurate measuring values and to keep minimum relative error. The clock schemes and constraints [6][10] are considered in integrating pipeline with the present system.

The figure 1&2 are showing the control bits through which the port pins are controlling by setting and resetting the bits. The port pins are connected with road traffic signals. The bits are controlling the Programmable peripheral interface port pins. Each of the port pin is connected with traffic signals and various other transducers output connectors.

Figure 1: Control word to set and reset traffic signals at control station

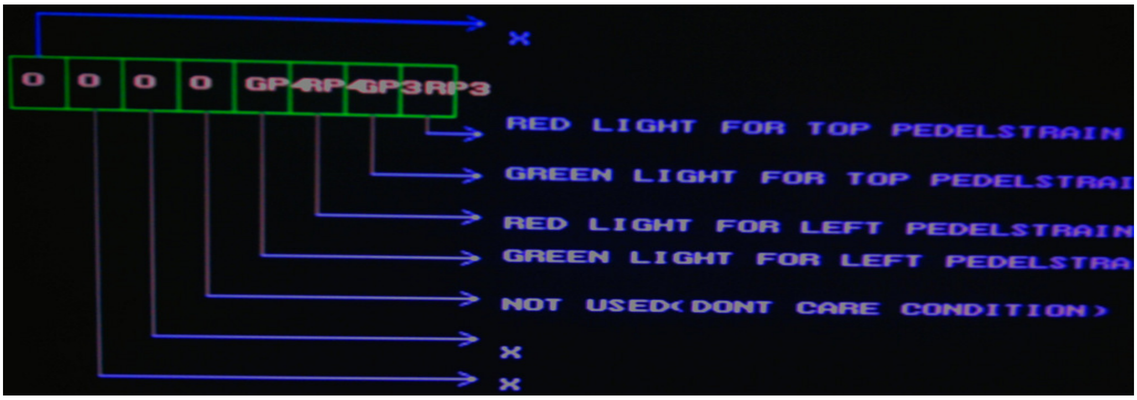

Figure 2: Control word to set and reset pedal strain signals at control station

III. SIMULATIONS

The situations are simulated and tested on Data Acquisition System. The ideas are implemented in idealized environment. The simulations are obtained on static objects in the laboratory environment. But in real time application a detailed study of environment conditions is required and need to study different cases of dynamic objects. Simulated software is developed on Intel core 2dual processor to meet the present requirement. Basically the software is developed to interface different peripherals to make interface with external input output devices [8]. The software is again redesigned with some modifications to make compatible with the present system. The software is designed to access different physical parameters with parallel ports. The parallel port addresses areaccessed by port programming written in object oriented environment. The Graphical User Interface is designed in graphics programming [8]. The programs are executed in turbo C++ environment.
The simulation in figure 3 is showing the manual operation of the traffic signal. It showing the green light of east side road is activated. And all other sides'signals are blinking red. The blue line on pedalstrains on north and south side indicates people can cross the road.

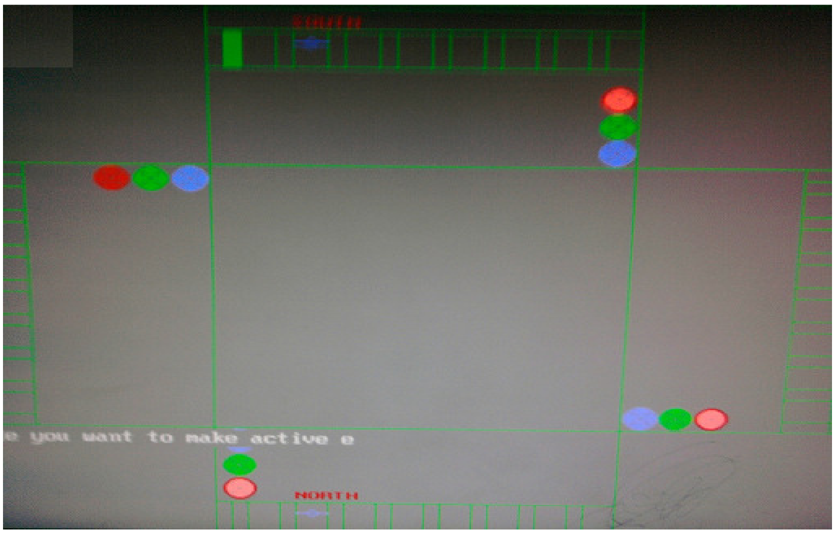

Figure 3: Manual operation of the traffic signal

The simulation in figure 4 is showing the automatic operation of the traffic signal. It showing the green light of south side road is activated. And all other sides' signals are blinking red. The red line on pedal strains of east and west side indicates people can cross the road. Figure 5 is showing an image of objects present on the road. The green colour points are representing the thermal objects on the road. The heat objects are recognized by thermal sensors placed on the road side.

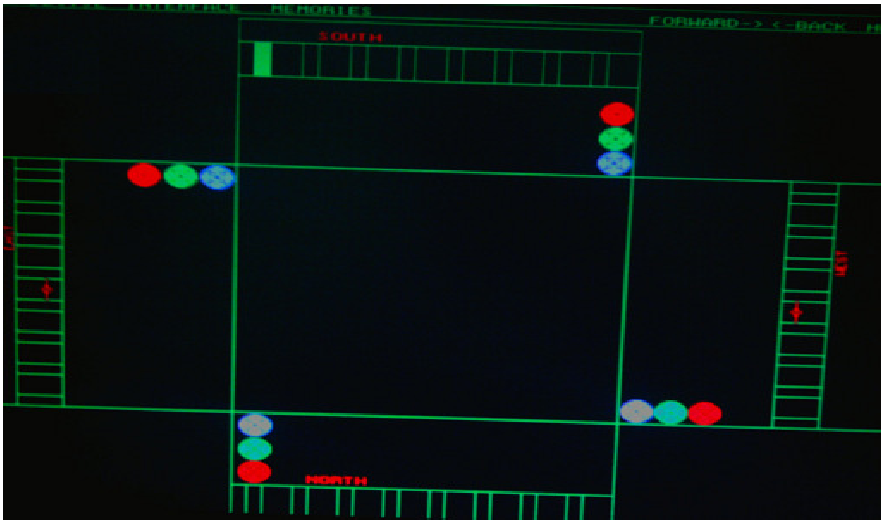

Figure 4: Automatic traffic control System

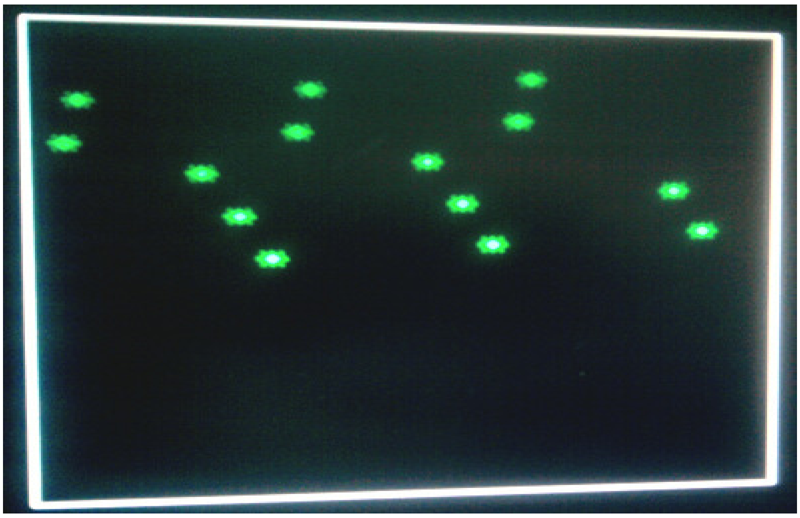

Figure 5: Thermal based image of objects on a road simulated in lab

IV. CONCLUSIONS

The Installation of the system at real time is very easy. The system is fully automated and intelligent to take decision in many critical situations. The system is designed to produce most accurate results by the help of latest technology implementations like pipeline. The system is designed to take multiple parameters at a time and intelligent to perform multiple processes parallel. The system is tested and designed for ideal conditions. Only software modification is required for 3-D image patterns of the objects. The system is tested and operated in static lab environment and minimal dynamic objects. But in future we are trying to develop and test the same technological system in real time environment.

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Biography

P. J. Rao (P. JagannadhaRao) has passed out B.Tech (Chemical Engineering) and M.Sc. (Mineral Process Engineering) during the years 1982 and 1984 respectively. He is processing 22 years of Industrial, consultancy and 6 years of Academic experience in various Industries of repute and Department of Chemical Engineering, Andhra University. He has the hands on experience in the fields of Production, Process, Environmental Management and Industrial Safety. He had been associated with industries include Petrochemical, metallurgical, Pharma, Chemical, Agro processing, Tanneries, cement, sugar, beach sand processing, fertiliser, sugar, steel tec. Presently he is working as Associate Professor in the dept. of Chemical Engineering. He had been awarded Ph.D in Chemical Engineering during the year 2011.

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