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SMART TRAFFIC CONTROL

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Abstract - *This paper depicts the idea of a modern traffic management system for life emergency and national security service vehicles. There are three main features in this project. First Density based traffic control management. Second to provide traffic-free path for life emergency vehicles (ambulance, fire brigade, and VVIP escorts). Third provides automation for Pedestrian cross over. All the above three features are controlled by PLC(Programmable Logic Controller). It is the main controller, which controls all the actions of the traffic system using ladder programming.*

Key Words: PLC, FSR, Traffic Management , Emergency vehicles.

1. INTRODUCTION

In today's modern world, traffic congestion is one of the major problems of many cities worldwide. As population increases day by day, sequentially the transportation of vehicles also increases. Due to this traffic, there is a lack of time management in our modern society and it also contributes to the wastage of fuels such as(petrol and gasoline). Hence there is a need for smart traffic management. There are many cases where patients lose their lives on the way to the hospital. When it comes to national security vehicles and VVIP escorts, path clearance is done manually through human bodies, where it requires more time to clear the lanes. Thus the main objective of this project is to control the traffic system automatically.

Traffic accidents which involve pedestrian have become a major safety problem in many of the countries. As per the survey made by the government, it was estimated about 12,385/year pedestrian deaths were reported. Also, there is only limited research that focuses on the pedestrian cross over causality. So, the project provides automation for pedestrian cross over.

There are different methods to control the traffic system like PLC, Micro-controller, and raspberry pi. PLC's have been used in a wide range of industries for its automation purpose, which can control multiple functions and operations. It is flexible and reliable to use and allows users to monitor accurately like alarm, sensors, etc. PLC's are made available with a large number of inputs and outputs.

Hence, the overall project is to design the smart traffic management system for future smart cities. Therefore the project uses many sensors and components for smart traffic control.

2. METHODOLOGY

2.1 Density-based traffic control management

In the present scenario, the traffic control system is static. For each lane, a certain amount of time is being pre-set. But there is no priority available for dense lanes. To manage such traffic flow systems, an idea of priority based control system have been proposed. Here, the sensors have been placed at a certain distance away from each signal. When the number of vehicles at the path exceeds a certain limit, and if the sensor receives signals continuously from the vehicles for more than 5 seconds, which here is a dense lane then the sensor inturn triggers the PLC from which the traffic signal controlling takes place. Therefore, the signal turns green at such dense lane.

2.2 Provide a traffic-free path for emergency vehicles

Nowadays, to clear the path for life emergency vehicles, human bodies are required to clear the lane. This process consumes time. When an emergency vehicle is stuck in a traffic signal and is unable to reach its destiny in such cases the ambulance driver can access an android application authorized to him through this application the driver can switch the traffic signal to green and clear that particular lane. After which the signal is back to normal sequence. All the changes in the traffic signals are done via PLC.

2.3 Automation for pedestrian cross over

Usually, to cross over the path huge number of pedestrian will have to wait for very long time. To overcome this problem FSR is being placed as a weight measuring equipment in this project. A platform is provided for the pedestrian to stand, a predetermined value of weight is

programmed using Arduino Uno, whenever the value reaches beyond the predetermined weight, the Arduino controller activates the signal helping pedestrian cross-over instantaneously.

3. BLOCK DIAGRAM

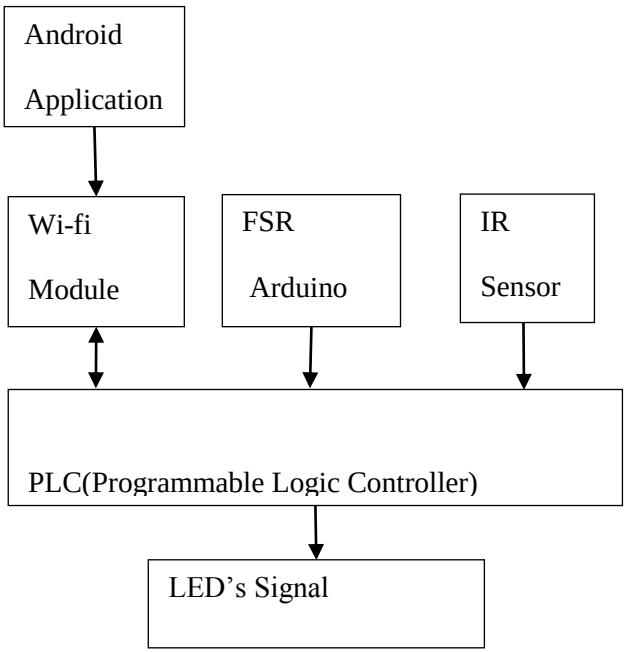

Fig -1: Architecture overview

4. WORKING PRINCIPLE

4.1 Software

PLC is used for continuous monitoring of input values from the sensors and produces the outputs for the operation of actuators based on the program. PLC Mitsubishi's FX1N series is being used. These PLC series are widely used for automation and industry purposes. It consists of 16 digital input and output ports, ladder programming can be done up-to 8000 steps. 8kb of EPROM memory, 32 bit MCU with all the arithmetic operations. In this project LD(Ladder Diagram) is used as a programming language.

GX developer software is being used for programming PLC and the simulations are done using GX simulator software. This software is easy and reliable to use. The programming is dumped into the PLC hardware with the help of RS232 port.

4.2 Hardware Requirement

The combination of hardware components that are used in this project i.e, Wi-Fi module, FSR, IR sensors, and LED's.

4.2.1 Wi-Fi module

The ESP8266 Wi-Fi module is being used to clear path for emergency vehicle and can be controlled with the help of an android application (Blynk app). It acts as an intermediate in between android application and PLC.

4.2.2 FSR(Force Sensitive Resistor)

To determine the weight of the pedestrians to cross over the path. When the weight exceeds the pre-set value the signal turns GREEN.

4.2.3 IR sensor

This is used to detect the density of the lane. It senses the continuous signal of a vehicle passing through the lane to the main controller (PLC).

4.2.4 LED's

The LED's are used for indicating the traffic signals. RED, YELLOW and GREEN are the colored LED's which operates at different voltage level.

Color	Voltage(V)
Red	1.9-2.4
Yellow	1.9-2.4
Green	3.0-3.4

Table -1: Voltage Range Of LED Diodes

As in normal traffic conditions, a sequence of timer-based operation is being operated. Similarly, this project works on the same process. Where in which the RED signal is being operated for 57 seconds. YELLOW is being operated for 3 seconds and the signal turns GREEN for 17 seconds and the sequence will be repeated for all the four lanes. It starts from lane 1,2,3,4 and keeps on repeating the sequence until the system is turned on. In each lane an IR sensor is placed, it recognizes the density in the four lanes. The signal jumps from static to dynamic, when the IR sensor is being activated for more than 5 seconds, then the

signal turns GREEN at its respective lane. The GREEN signal is turned on for 17 seconds after this operation is completed, it jumps back to normal sequence.

(Note-Here the time seconds for each signal can be varied.)

when it comes to emergency vehicles, the flow of the signal will be same as mentioned in the above paragraph. The signal changes to green for 17 seconds, allowing the emergency vehicle to pass the lane. Here an android application is used to send the signal to PLC with the help of the Wi-Fi module, which is only controlled by the authorized person (Driver). Once the operation is completed the signal gets back to the normal sequence.

(Note-Here the time seconds for each signal can be varied.)

To provide a safe and secure path for the national security vehicle. An android application will be provided for an authorized person who is in charge of the safety services. The authorized person will be sending the signal to the PLC with the help of the Wi-Fi module to clear particular lanes this is done prior by blocking all the other lanes so that the escorts service can clear the traffic and pass safely after the operation is being completed conventional traffic takes over. Refer to Figure 2.

Fig -2: Wi-Fi module with Android application (Blynk app)

A secure path is provided for pedestrian to cross over in between lanes. The project provides a platform for pedestrians to stand. A predetermined value is being set in the program using the Arduino Uno and measurement of weight is done with the help of FSR. Here in this project, FSR acts as a weight measuring equipment. Whenever the pedestrians occupies the platform their respective weight is measured by FSR and when it exceeds the predetermined value the PLC gets triggered and the signal turns to GREEN as shown in figure 3. For the vehicles, the signal turns RED so that the pedestrian can cross over the path safely.

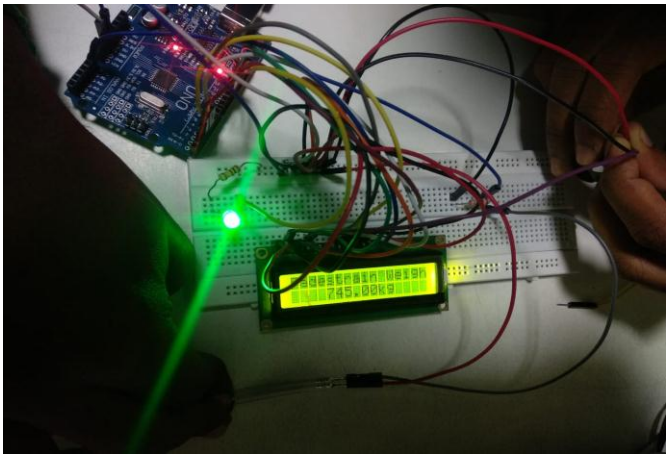

Fig -3: Arduino Uno with FSR and LCD

5. CONCLUSION

The overall output of this project gives the following result. Time consumption is very less when stuck in traffic, wastage of fuel and pollution caused during traffic can be reduced and it avoids unwanted stress caused during traffic congestion. Many lives can be saved due to the priority given for emergency vehicles (ambulance, VVIP escorts) traffic signal. Major accidents and injuries can be avoided to pedestrians during their cross over in between lanes.

Overall it contributes to the development of smart cities thus improving country's economy and protects many civilian's life on a daily basis.

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