SMART TRAFFIC MONITORING AND CONTROLLING

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Abstract - Traffic light control systems are widely used to monitor and control the flow of automobiles through the junction of many roads. However, the synchronization of multiple traffic light systems at adjacent intersections is a complicated problem given the various parameters involved. Conventional systems concentrate mainly on allotting equal time to all the lanes. In addition, the mutual interference between adjacent traffic light systems, the disparity of cars flow with time, the accidents, the passage of emergency vehicles, and the pedestrian crossing are not implemented in the existing traffic system. This leads to traffic jam and congestion. The paper propose a system based on ATMEGA16 microcontroller that evaluates the traffic density using Laser sensors and accomplishes dynamic timing slots with different levels. Moreover, a portable controller device is designed to solve the problem of emergency vehicles stuck in the overcrowded roads and notifying the vehicles the current traffic scenario

Keywords – RFID, IoT, Arduino Atmega16, Esp8266 Wi-Fi.

1. INTRODUCTION

Over the years, there has been a sudden increase in the number of vehicles on the road. Traffic congestion is a growing problem everyone faces in their daily life. Manual control of traffic by traffic police has not proved to be efficient. Also the predefined set time for the signal at all circumstances (low and high traffic density) has not solved this problem. A model to effectively solve the above mentioned problems by using Internet of Things (IoT) is proposed. We use cloud for internet based computing, where different services such as server, storage and application are delivered for traffic management. A network of sensors is used to track the number of vehicles and the traffic congestion at the intersections on a road and rerouting will be done on the basis of the traffic density on the lanes of a road.Objective of this project is to design and develop IOT based Traffic monitoring and controlling system. System will clear the path of the traffic by controlling the traffic lights. The traffic Man will have android phone will connect to the system using IOT link and set the path on the application. Suppose the driver wants to go through the path a, b, c and d to reach the destination. Then the system will control the traffic lights of path a, b, c, d and switch green signal ON.
This system will also control the traffic lights by sensing the traffic density.
The system deals with an innovative idea of IOT based traffic monitoring and controlling system. In this system we will control the traffic light of each path in the city with the help of a central unit. In the central unit we will use atmega16 microcontroller to the control the system. The traffic controller will have android phone on the phone a software running on it software will have all the information about the route. Phone is communicated with system using IOT link. When the controller wants to connect to the system to control the traffic lights he has to enter the password. Suppose the driver wants to go through the path a, b, c and d to reach the destination so he will set the path on software. Then the system will control the traffic lights of path a, b, c, d and switch green signal ON. After passing the ambulance through the path the system will start working as usual.

2. LITERATURE SURVEY

BANGALORE: Six months ago, a two-year-old girl was being rushed in an ambulance from Mysore Road to Maniple Hospital on Old Airport Road. The child was suffering from low BP and struggling to breathe. It took more than two-and-a-half hours to cover the 15-km stretch, owing to traffic snarls. When she finally reached the hospital, she was death.
In September 2012, a middle-aged man collapsed on the road after suffering a heart attack near NGEF circle, on Old Madras Road. An ambulance from a multispecialty hospital on Old Airport Road was scrambled to fetch him. But it got stuck in traffic and the man passed away. His wife asked police what they were doing about the insensitivity of motorists to ambulance movement. The embarrassed traffic police attended the funeral and paid their last respects .
These aren't stray cases. Death does strike aboard the ambulance too but there is no way it is declared as such. Most 'brought dead' and 'died en route' cases happen where there is a time lapse in shifting the patient from one place to another due to traffic snarls, the bane of Bangalore. Additional commissioner of traffic B Dayanand admits to the chaos on the road, especially during peak hours. The travel speed in the city is a crawling 15km per hour during peak hours. "Our roads are not ambulance friendly most often. It is difficult but we are managing ," says Dr Pramod RK, head of medical service, EMRI, which is part of the 108 ambulance service operated by the state government. The 108 service has assisted 29.4 lakh people in various health emergencies like pregnancies, respiratory and cardiac disorders , snake bites, suicides and traffic accidents , among many others. Strategically placed 517 ambulances armed with all life-support medicines and equipment and manned by trained personnel render emergency health care. Cadaver organs: Time is of essence not only in medical emergencies and road accidents but also cadaver organ transplantation. "Organs are harvested from the brain-dead patient and well-secured with ice packs. We ensure precious organs

don't get wasted due to traffic snarls," says Dr MM Satish Kumar, joint secretary, Zonal Coordination Committee of Karnataka (ZCCK) for organ transplants.

3. EXISTING SYSTEM

The exiting traffic system is generally controlled by the traffic police. The main drawback of this system controlled by the traffic police is that the system is not smart enough to deal with the traffic congestion. The traffic police official can either block a road for more amount of time or let the vehicles on another road pass by i.e. the decision making may not be smart enough and it entirely depends on the official's decision. Moreover, even if traffic lights are used the time interval for which the vehicles will be showed green or red signal is fixed. Therefore, it may not be able to solve the problem of traffic congestion. In India, it has been seen that even after the presence of traffic lights, traffic police officials are on duty, which means that in this system more manpower is required and it is not economical in nature.(Viswanathan and Santhanam, 2013)

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4. PROPOSED SYSTEM

The first and primary element of this system is the wireless sensor nodes consist- ing of sensors. The sensors interact with the physical environment means vehicles presence or absence while the local server sends the sensors data to the central microcontroller. This system involves the 4*2 array of sensor nodes in each way. This signifies 4 levels of Traffic and 2 lanes in each way. The sensors are ultrasonic sen- sors which transmits status based on presence of vehicle near it. The sensor nodes transmit at specified time intervals to the central microcontroller placed at every intersection. The Microcontroller receives the signal and computes which road and which lane has to be chosen based on the density of Traffic. The computed data from Microcontroller is then transmitted to the local server through Wi-Fi connectivity. The controller makes use of the collected data to perform the Intelligent Traffic rout- ing. In this system, the primary aim is to gather the information of moving vehicles based on WSN to provide them a clear path till their destinations and traffic signals should switch automatically to give a clear way for these vehicles.

A. Hardware Components:

a. **RFID Reader** - RFID can read and write Mifare's tags and are available in various online stores. Microcontroller and card reader use SPI to communicate. The reader and tag interact with the 13.56 MHz electromagnetic field. The working principle of the RFID reader is the induction of electromagnetic waves. The RFID reader emits electromagnetic waves through the built-in antenna and reads the measured value of the RFID tag within a certain range of 0-12m. Whenever a product enters the range of an RFID reader it reads data stored on RFID tags.It implemented on intersection of road lane.

Fig 1. RFID Reader Module (EM18)

b. **Microcontroller (Arduino ATmega16)**: The Arduino ATMega16 is a micro- controller board based on the Atmega16. It has 40 digital input/output pins (of which 15 can be used as PWM outputs), 16 analog inputs, 4 UARTs (hardware serial ports), a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.
The ATmega16 is a 8-bit microcontroller based on the AVR enhanced RISC architecture.
By executing powerful instructions in a single clock cycle, the ATmega16 achieves throughputs approaching 1 MIPS per MHz allowing the system designer to optimize power consumption versus processing speed.

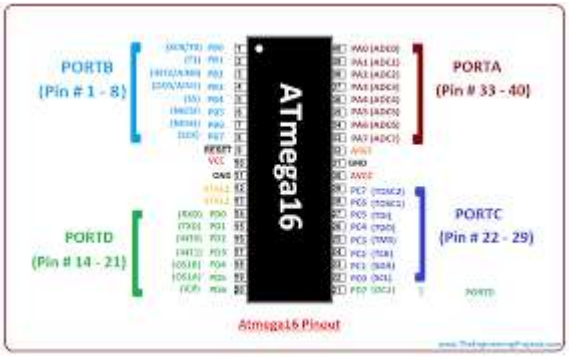

Fig 2. Pin diagram of ATmega16

c. Arduino Uno - Arduino Uno is a microcontroller board called Arduino Uno, which is based on the ATmega16 series of controllers. It provides developers and programmers with an integrated development environment in which various operations such as writing, compiling and downloading codes can be easily performed. Arduino Uno is an open-source prototyping platform based on user-friendly hardware and software. It has 14 digital input and output pins and 6 analog inputs for communication with sensors, switches, motors and other electronic components. It has a 16 MHz ceramic resonator, a USB connection, an external power connection and an in-circuit serial programmer (ICSP) connection, a reset button, GND pin as ground and a 5V pin to provide 5 voltages. The voltage is 5 V, and the input voltage is 7 to 12 V.

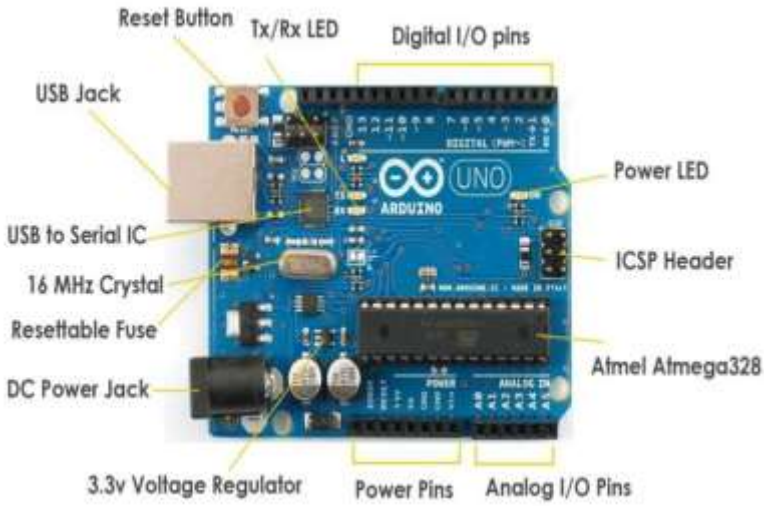

Fig 3. Arduino Uno

d. IR sensor - In order to measure the density of **traffic** on each side, **IR sensors** will be kept on either sides of the **road** at a specific distance. ... As the vehicle passes through these **IR sensors**, the **IR sensor** will detect the vehicle & will send the information to the Arduino.

e. ESP8266 - The ESP8266 Wi-Fi Module is a self contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network.The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor.

Each ESP8266 module comes pre-programmed with an AT command set firmware, meaning, you can simply hook this up to your Arguing device and get about as much Wi-Fi-ability as a Wi-Fi Shield offers (and that's just out of the box)! The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.

B. Software Component:

a) AVR studio IDE: **AVR Studio** is an Integrated Development Environment (IDE) for writing and debugging **AVR** applications in Windows 9x/ME/NT/2000/XP/VISTA environments. **AVR Studio** provides a project management tool, source file editor, simulator,assembler and front-end for C/C++, programming, emulation and on-chip debugging.

b) Proteus Design Suite: The Proteus Design Suite is a proprietary software tool suite used primarily for electronic design automation. The software is used mainly by electronic design engineers and technicians to create schematics and electronic prints for manufacturing printed circuit boards.

C. Working:

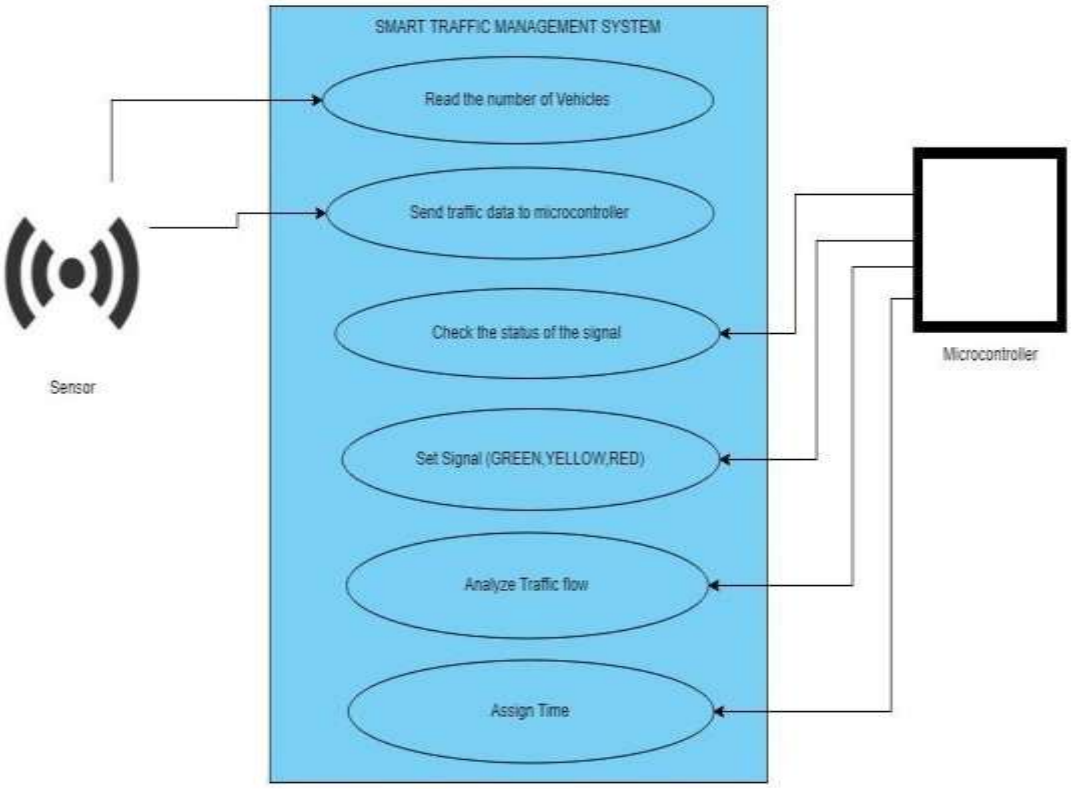

Figure- Case Diagram

Algorithm:-

Vehicle Counter Algorithm

Assuming the objects detected by the IR Sensors to be vehicles, int counter = 0;
int hitObject = false; int val ;
Step 1: Read value from sensor (val). Sensor gives output 0 if car is detected and 1 if no car is detected.
Step 2: If val == 0 hitObject = false then increment the counter and set hitObject
= true.
else if val == 1 hitObject = true then set hitObject = false.

Step 3: Go to step 1

Traffic Control Algorithm

No. of sensors = 8 and are denoted by S1, S2, S3, S4, S5, S6, S7, S8 No. of cars in Lane 1 (N1) = S1 – S2
No. of cars in Lane 2 (N2) = S3 – S4 No. of cars in Lane 3 (N3) =
S5 – S6 No. of cars in Lane 4 (N4) = S7 – S8
Li = (L1, L2, L3, L4), Ni = (N1, N2, N3, N4), Ti = (T1, T2, T3, T4)
Step 1: Start

Step 2: Sensors will read the no. of vehicles on each lane (i.e. L1, L2, L3, L4)
Step 3: if (Vehicle Count < Threshold)

Then status = Normal traffic. Turn on the green signal for all the lanes one after another in a sequential manner (L1-L2-L3-L4). When signal is green for one lane,the others will remain red.
Step 4: else status = congestion.

Step 5: COMPARE (N1, N2 , N3, N4), Select the highest of the four (say Ni),turn on green signal for that lane (say Li) for time (Ti). When time Ti ends, turn on the red signal.
Step 6: COMPARE (N2, N3, N4), Select the highest of the three (say Ni), turn on green signal for that lane (say Li) for time (Ti). When time Ti ends, turn on the red signal.
Step 7: COMPARE (N3, N4), Select the highest of the two (say Ni), turn on green signal for that lane (say Li) for time (Ti). When time Ti ends, turn on the red signal.
Step 8: The last remaining lane automatically gets selected and it is given the green signal for time Ti.
Step 9: Jump to Step 3.

5. COMPARISON OF EXISTING AND PROPOSED SYSTEM

The proposed system helps in better time based monitoring and thus has certain advantages over the existing system like minimizing number of accidents, reducing fuel cost and is remotely controllable etc.
The proposed system is designed in such a way that it will be able to control the traffic congestion as well as track the number of vehicles. The administrator of the system can access local server in order to maintain the system.

6. CONCLUSION AND FUTURE RESEARCH

Smart Traffic Management System has been developed by using multiple features of hardware components in IoT. Traffic optimization is achieved using IoT platform for efficient utilizing allocating varying time to all traffic signal according to available vehicles count in road path. Smart Traffic Management System is implemented to deal efficiently with problem of congestion and perform re-routing at intersections on a road.
This research presents an effective solution for rapid growth of traffic flow partic- ularly in big cities which is increasing day by day and traditional systems have some limitations as they fail to manage current traffic effectively. Keeping in view the state of the art approach for traffic management systems, a smart traffic man- agement system is proposed to control road traffic situations more efficiently and effectively. It changes the signal timing intelligently according to traffic density on the particular roadside and regulates traffic flow by communicating with local server more effectively than ever before. The decentralized approach makes it optimized and effective as the system works even if a local server or centralized server has crashed. The system also provides useful information to higher authorities that can be used in road planning which helps in optimal usage of resources

In the above documents, the system design for future directions, different priority levels for multiple incidents and scenarios can be considered. The main issue with IoT is that the security of the entire sys- tem have to be concentrated on and not a particular IoT layer, device or software. Hence, integrating the entire traffic management system with multiple layer secu- rity for various data generated from various sources can be another subject of future scope. Along with that an emergency signal for an emergency vehicle (such as an Ambulance) can also be included in order to serve them better.

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