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AN ADVANCED AMBULANCE RESCUE SYSTEM USING PRIORITIZED TRAFFIC SWTCHING

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ABSTRACT

Traffic management system is considered as one of the major dimensions of a smart city. With the rapid growth of population and urban mobility in metropolitan cities, traffic congestion is often seen on roads. To tackle various issues for managing traffic on roads and to help authorities in proper planning, a smart traffic management system using the Internet of Things (IoT) is proposed in this paper. A hybrid approach (combination of centralized and decentralized) is used to optimize traffic flow on roads and an algorithm is devised to manage various traffic situations efficiently. For this purpose, the system takes traffic density as input from a) cameras b) and sensors, then manages traffic signals. Another algorithm based on Artificial Intelligence is used to predict the traffic density for future to minimize the traffic congestion. Besides this, RFIDs are also used to prioritize the emergency vehicles such as ambulances and fire brigade vehicles during a traffic jam. In case of fire on the road, Smoke sensors are also part of this system to detect this situation. To demonstrate the effectiveness of the proposed traffic management system, a prototype is developed which not only optimizes the flow of traffic but also connects nearby rescue departments with a centralized server. Moreover, it also extracts useful information presented in graphical formats that may help the authorities in future road planning.

1. INTRODUCTION

Human life is affected due to delay in the arrival of ambulance. The ambulance is not able to reach the hospital in the golden hour. It gets stuck in the traffic signals. It would be of great use to the patient if the traffic signals in the path of the ambulance are ON. There must be a system by which the ambulance would reach the accident spot and then hospital as soon as possible to carry out health services [1]. The existing systems are post accident detection systems. It has lack of intelligence. It fails to track the rear-end collision and predamage status. It depends on the way of monitoring people to be manual. It requires manual work to save human life which results in time delay and because of that first aid cannot be provided to the patient on time. This leads to loss of human life. In Pre-collision system, one or more systems may not activate due to sensing

and tracking limitations. The actual field performance may be less effective. Limitations in the algorithms and sensors may cause difficulty in real world applications. Moreover, it may use more complex algorithms to determine collision risk. There will be different effectiveness for different algorithms. For the driver's state, there was only limited information available prior to the collision. There was no effect of pre-collision systems on driver maneuvers such as steering, other than breaking. Further simulation of driver braking deceleration without instrumentation in real-world collision was not feasible beyond constant magnitudes. It did not capture all braking inputs of driver that were possible [2]. These are the disadvantages of existing system. In this paper, we have described a design for automatically controlling the traffic signals so that the ambulance would be able to cross all the traffic junctions without time delay [3]. The server keeps a database for each node for easy access. Hence, each node will have a unique id for addressing the data. The ambulance is guided to the hospital by the server through the shortest route. The sensor installed in the vehicle senses the accident and Global Positioning System (GPS) tracks the location of the accident [4]. Through GSM (Global System for Mobile Communications), it sends the location of the accident to the ambulance section. The buzzer produces sound when accident occurs. The central unit finds the ambulance, nearest to the accident spot and also the shortest path between the location of the accident, ambulance and the nearest hospital. Here, wireless technologies are used for information transferring. The traffic signals on the path of the ambulance are controlled. When the ambulance reaches the traffic junction, the encoder converts the serial data into parallel data when it passes from the transmitter to the receiver. If the signal is red, it comes to green automatically. The decoder in the receiver section converts the parallel data into serial data when it is sent back. This helps the ambulance to cross the traffic junction as soon as possible. The prioritized traffic switching is done priority wise, i.e. if two ambulances are coming at the same time, the ambulance which will arrive first at the traffic junction will be given the priority to cross the traffic junction before the next ambulance arrives [5]. In this way, using wireless technologies, the information is transferred and the traffic signals are controlled so that the ambulance would be able to reach the hospital on time.

2. EXISTING SYSTEM:

- An automatic alarm device for traffic accidents is designed in this paper. It can shorten the alarm time greatly and locate the accident spot accurately, realizing the automation of accident detection and information transmission.
- Consequently, it will save the rescuers form wasting their time in search. The experiments of model car's collision and rollover proved that this system can automatically detect corresponding accident and sent related information.
- Such functions can be achieved by buttons representing "false alarm", "help" and "safety", respectively.

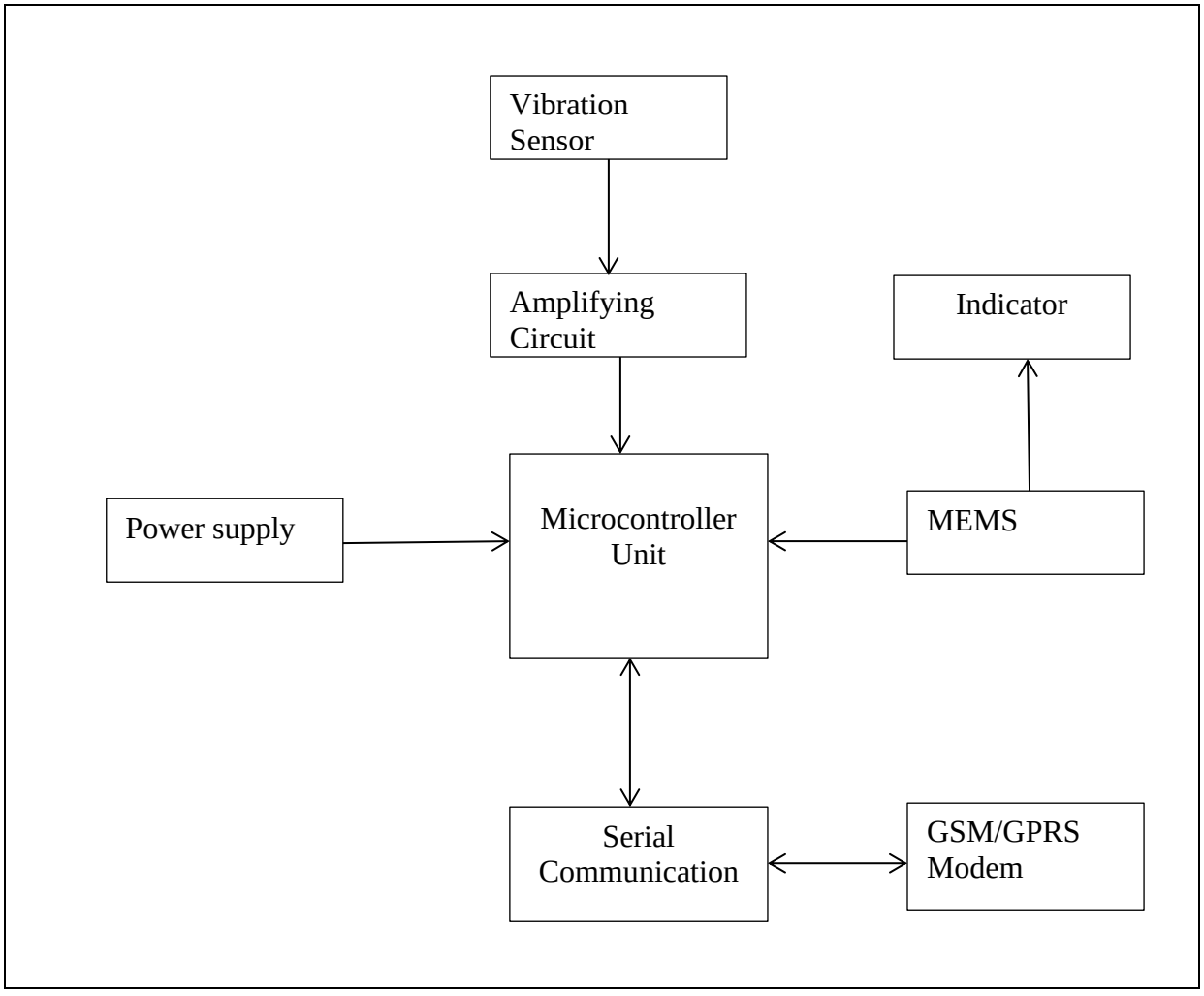
3. PROPOSED SYSTEM :

- A design for automatically controlling traffic signals so that ambulance would be able to cross all traffic junctions without waiting. In vehicle section, vibration sensor monitors the speed and if it is over speed, alert will be produced and automatically speed will be reduced.
- For rash driving, we have placed MEMS sensor. Once MEMS gets tilted, message will be sent through GSM with location. Once receiving the message, ambulance will arrive

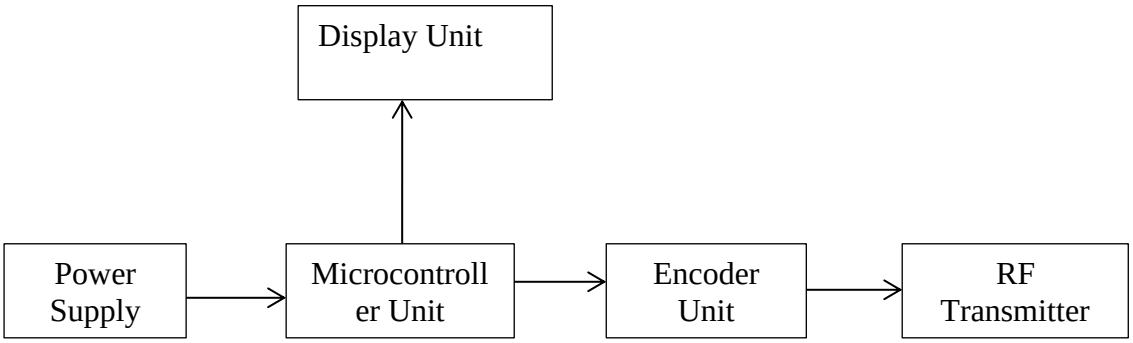
to the particular section. The display unit in ambulance section is used for driver's reference.

- It will show the names and distances of the nearest hospitals so that ambulance can reach hospital as soon as possible. The signal section receives the signal from ambulance section and signal comes to green automatically. It helps ambulance to reach hospital without any traffic problem.

4. BLOCK DIAGRAM FOR VEHICLE SECTION



5. BLOCK DIAGRAM FOR AMBULENCE SECTION



6. HARDWARE COMPONENTS :

- Vibration sensor
- Amplifying Circuit
- Indicator
- Power Supply
- Microcontroller Unit
- MEMS
- GSM/GPRS modem
- Serial Communication
- Display Unit
- Encoder Unit
- RF Transmitter

7. VIBRATION SENSOR

The **vibration sensor** is also called a piezoelectric **sensor**. These **sensors** are flexible devices which are used for measuring various processes. This **sensor** uses the piezoelectric effects while measuring the changes within acceleration, pressure, temperature, force otherwise strain by changing to an electrical charge.

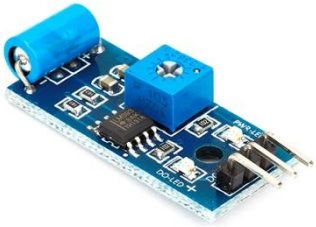


Figure 1 Vibration Sensor

8. AMPLIFYING CIRCUIT

An **amplifier** is a **circuit** that has a power gain greater than one. An **amplifier** can either be a separate piece of equipment or an electrical **circuit** contained within another device. Amplification is fundamental to modern electronics, and **amplifiers** are widely used in almost all electronic equipment.

Figure 2 Amplifying circuit

9. Indicator

In various contexts of science, technology, and **manufacturing** (such as machining, fabricating, and additive **manufacturing**), an indicator is any of various instruments used to accurately measure small distances and angles, and amplify them to make them more obvious.

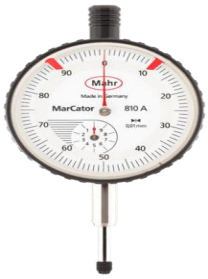


Figure 3 Indicator

10.POWER SUPPLY

Landscape lighting, however, is typically supplied in lower voltage (12 Volts) spread out through several different lights. A **transformer** can convert the 120v electrical currently supplied from your house down to the **12v** needed for each low voltage landscape lighting fixtures in your lawn!

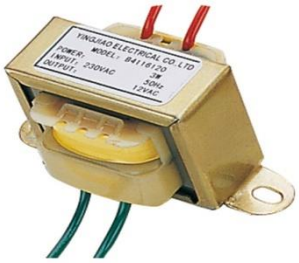


Figure 4 Power supply

11. MICROCONTROLLER

A **microcontroller** (abbreviated MCU or µC) is a computer system on a chip that does a job. It contains an integrated processor, memory (a small amount of RAM, program memory, or both), and programmable input/output peripherals, which are used to interact with things connected to the chip.

Figure 5 Microcontroller

12. MEMS

Micro-Electro-Mechanical Systems, or **MEMS**, is a technology that in its most general form can be defined as miniaturized mechanical and electro-mechanical elements (i.e., devices and structures) that are made using the techniques of microfabrication.

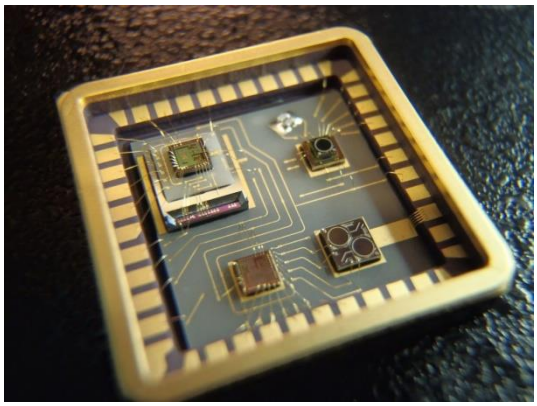


Figure 6 MEMS

13. GSM/GPRS MODEM

The Global System for Mobile Communications (**GSM**) is a standard developed by the European Telecommunications Standards Institute (ETSI) to describe the protocols for second-generation (2G) digital cellular networks used by mobile devices such as mobile phones and tablets.A **GPRS modem** is a GSM **modem** that additionally supports the **GPRS** technology for data transmission. **GPRS** stands for General Packet Radio Service. It is a packet-switched technology that is an extension of GSM. (GSM is a circuit-switched technology.) **GPRS** can be used as the bearer of SMS.

Figure 7 GSM/GPRS Modem

14. SERIAL COMMUNICATION

In telecommunication and data transmission, **serial communication** is the process of sending data one bit at a time, sequentially, over a **communication** channel or computer bus. This is in contrast to parallel **communication**, where several bits are sent as a whole, on a link with several parallel channels.

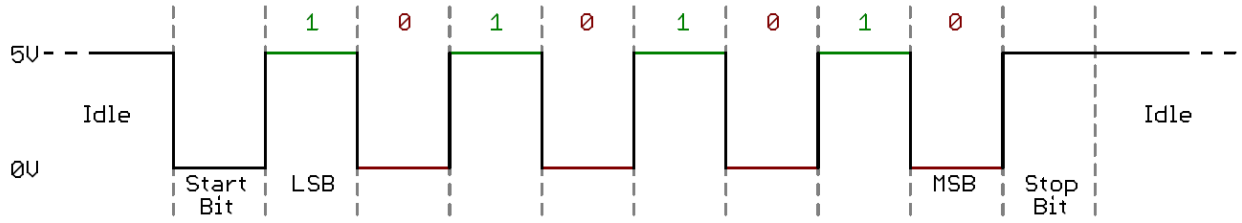


Figure 8 Serial Communication

15. DISPLAY UNIT

A **display device** is an output **device** for presentation of information in visual or tactile form (the latter used for example in tactile **electronic displays** for blind people). When the input information that is supplied has an **electrical** signal the **display** is called an **electronic display**.

Figure 9 Display Unit

16. ENCODER UNIT

In general an **encoder** is a device or process that converts data from one format to another. In position sensing, an **encoder** is a device which can detect and convert mechanical motion to an analog or digital coded output signal.

Figure 10 Encoder Unit

17. RF TRANSMITTER

An **RF transmitter** receives serial data and transmits it wirelessly through **RF** through its antenna connected at pin4. The transmission occurs at the rate of 1Kbps – 10Kbps. The transmitted data is received by an **RF** receiver operating at the same frequency as that of the **transmitter**

Figure 11 RF transmitter

18.CONCLUSION

In this paper, we have described a design for automatically controlling the traffic signals so that the ambulance would be able to cross all the traffic junctions and reach hospital without time delay. Human life is affected due to delay in the arrival of ambulance. The ambulance is not able to reach the hospital in the golden hour. The existing system has many disadvantages. It depends on the way of monitoring people to be manual which results in time delay and because of that health services cannot be provided to the patient on time which leads to loss of human life. In our proposed system, the ambulance is guided to the hospital by the central unit through the shortest route. The sensor installed in the vehicle senses the accident and Global Positioning System (GPS) tracks the location of the accident. Through GSM (Global System for Mobile Communications), it sends the location of the accident to the ambulance section. The central unit finds the ambulance, nearest to the accident spot and also the shortest path between the location of the accident, ambulance and the nearest hospital. Here, wireless technologies are used to transfer information.

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