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CHALLENGES AND INNOVATION IN EMBEDDED SYSTEM FOR REAL TIME APPLICATION

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Abstract- An Embedded System is the computer based system with a large dedicated function of large mechanical or electrical system, mostly based upon the real time computing constraints. The embedded system often include the hardware and mechanical parts for the process of implementing the system as the whole. The embedded system today used for the many devices for the process of controlling many devices. This embedded system are mainly based upon the microcontrollers. This paper deals with the challenges and innovative technologies that the embedded system today dealing with. The real time application also discussed in this paper. These discussion give the overall idea about the embedded system along with the real time application using the implementation of the embedded system components.

Keyword- embedded system, challenges , innovative technologies, real time application

1. INTRODUCTION

In the year of 1960s the embedded system has a dramatic rise in processing the power and their functionality. In 1978, programmable microcontrollers released by National Engineering Manufacturers Association using a single board computers, numerical and event-based controllers.

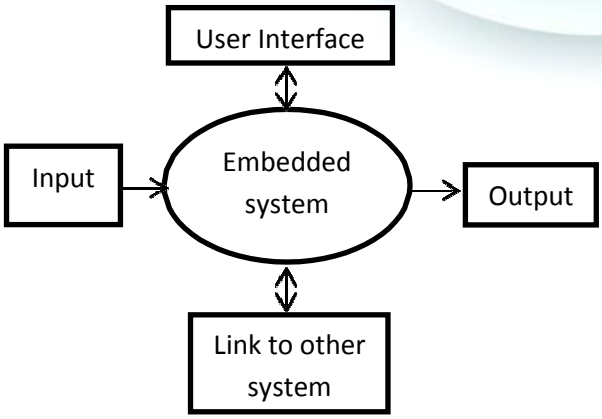

Figure 1: Outline of Embedded system

The low cost microcontrollers are programmed to fulfill their role as large number of separate component's. The microcontrollers find applications where a general-purpose computer would be cost effective.

Embedded System Types[10]

Embedded System are primarily classified into various types based on their complexity of a software, hardware and microcontroller and based the performance of the microcontroller and embedded system such as:

- Small scale embedded system.
- Medium scale embedded system.
- Sophisticated embedded system.

Also the embedded systems are classified based on the performance and functional requirements such as:

- Stand-alone embedded system.
- Networked embedded system.
- Real time embedded system.
- Mobile embedded system.

Embedded systems developed numerous applications in different fields such as digital electronics, computing networks , telecommunications, satellite systems, smart cards, military defense system equipment, research system equipment, etc. Embedded system are also used in navigation tools such as Automated teller machine (ATM), Global positioning system (GPS), digital video cameras and aerospace application. The embedded system and Real time operating systems are platform-less system.

2. CHALLENGES IN EMBEDDED SYSTEM

Various challenges of embedded system design involved are

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- Predictability
- Robustness
- Consolidation
- Decentralization
- Heterogeneity
- Security
- Energy Management
- Programming Models
- Migration Strategies.

Explanation of Challenges

Predictability deals with concept of non-deterministic and deterministic computation. The non-deterministic is a process of predicting the outcome process in different ways but they are all processed in continuous and it is difficult and expensive task. The next challenge is a **Robustness** they determine whether the behavior of their designed system is robust in presence of their perturbations and it deals based on the continuity of their system. **Consolidation** shifts the system from hardware to software environment, utilize multi-core system of the embedded applications and they provides account safety and real-time requirements. **Decentralization** is a flexible deployment of the functionality in a distributed systems. The heterogeneity process heterogeneous multi-core architecture and helps to execute the system in cloud computing environment. The embedded system provides data privacy for security and protects the data in their manipulation. Energy management improves the system efficiency by providing efficient power in both fro hardware and software design. In programming models, the developers design the system efficiently using their programming of achieving portability, hardware independence and scalability of processing power to multi-core systems. In migration strategy, they utilize the parallel hardware preserving existing code by increasing the data volume constantly.

3. CHARACTERISTICS OF EMBEDDED SYSTEM

The major characteristics of embedded system are

- General purpose micro processor
- User interface
- Power limitations
- General purpose computing platform
- Application software [8]

4. FUNCTIONS AND FEATURES OF EMBEDDED SYSTEMS [7]

The general functions of embedded system are

- Processing
- Communication
- Storage
- Each application have different requirement like processing, power supply, Storage and communication

The features of the embedded system are

- Final cost
- Time
- Life time
- Volume

5. REAL TIME APPLICATION USING EMBEDDED SYSTEM [3] [10]

The embedded system can be used in many real time applications. Some of them are

- Industrial Automation
- Medical field
- Vehicle Automation
- Telecommunication
- Electronic stability control

Embedded system used in Smart Cards, Missile, Satellite for

- Security system
- Aerospace and defense
- Communication
- Telephone and banking

Embedded system used in Peripheral and computer networking for

- Display and monitor the system
- Image processing
- Network cards and printers
- Networking system

Embedded system used in Consumer Electronics such as

- Digital Camera
- DVD
- Set top box
- LED and LCD TV

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6. GENERATIONS OF EMBEDDED SYSTEMS

Table 1: Embedded system Generation

Generation	Microprocessor	Microcontroller	Example
1	8 bit	4bit	Digital Telephone keypad
2	16 bit	8 bit	SCADA,ADC
3	32-bit	16 bit	Robotics
4	64 bit	32 bit	Smart phones

The above table provides a overview of embedded system generation along with its microcontroller and microprocessor.

7. INNOVATIVE TECHNOLOGIES IN THE REAL TIME APPLICATION

In this section, we discuss about various innovative technologies developed in traffic control system.

The authors Rajeshwari Sundar, Santhoshs Hebbar, et al proposed a automatic traffic control system[11]. In this article, the author used RFID tags, which counts the number of vehicle passes the particular location in a specified duration. This tag also determines the network congestion and controls green light for the path. If the vehicle attached with RFID tags is stolen, then immediately the message will be passed to police control room by using GSM SIM300. When the ambulance is coming along the congested area then, the ZigBee module of CC2500 and PIC16F877A makes communicate to the traffic controller to turn on green light. They proposed this project based on three modules such as:

- Automatic Signal Control System.
- Stolen Vehicle Detection System.
- Emergency Vehicle Clearance System.

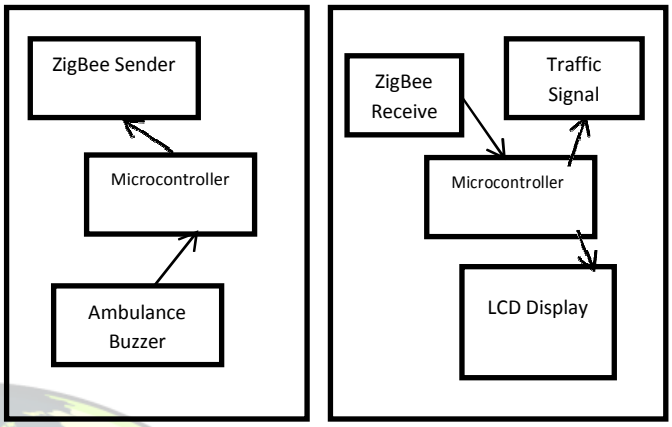

Figure2: Automatic signal control system.

To improve this system in advance, the author Linganagouda R, Pyinti Raju et al, proposed a intelligent traffic control system for four way line crossing path.[6] In this system, this system concentrates on problem faced by the priority vehicles, they have used IR transmitter and receiver to make the vehicles green lane and prevents traffic congestion. And also they concentrate on traffic density control, where the IR transmitter and receiver provide dynamic traffic control by increasing the duration of green light where the traffic density is high. To control traffic light, they have used System Time Manipulation. [9] discussed about Positioning Of a Vehicle in a Combined Indoor-Outdoor Scenario, The development in technology has given us all sophistications but equal amounts of threats too. This has brought us an urge to bring a complete security system that monitors an object continuously.

The components used in this intelligent traffic control system are:

- PIC Micro Controller (16F877A).
- Regulated Power Supply.
- 16x2 LCD Display.
- Smoke sensor.
- LED.
- IR Transmitter and Receiver.
- RF Transmitter and Receiver.

Advantages of smart ambulance system:

- Wide-range of applicability.
- One time of cost investment.
- Saves the life of people.
- Uses radio frequency signal.

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Advantages of Traffic Density Control System:

- Reduces number of accidents in a large extent.
- Provides easy control for traffic police.

The author Sagar Sukode and Shilpa Gite proposed Vehicle traffic congestion control and monitoring system in IoT to context-aware approach which finds the current status, density of traffic and dynamic management signals with their environmental conditions.[12] This system utilizes new techniques for the real time application, organization and provides efficient transmission of information, estimate the traffic density and weather conditions, which exploit traffic aware application. In this system, the sensor sends all the information to the microcontrollers and this microcontrollers transfers the received information to the mobile through the Bluetooth controller. And then, the android device sends information to the server over the web server through internet to store the collected details in the database. The server performs mining operations using k-Nearest Neighbor and Naïve Bayes algorithm to get the required results.

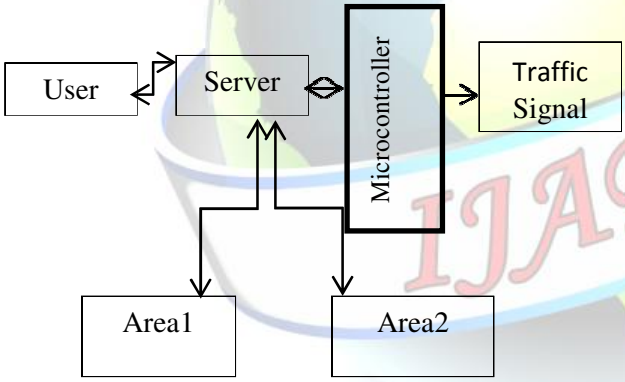

Figure 3: Block Diagram of Traffic Congestion Control and Monitoring System

When user needs to collect the traffic or weather condition, then user login to their android application, where this application request to the web server and the server sends the result of user requirement to the user. Through which the user can see their traffic density and data, traffic condition and their weather condition.

8. CONCLUSION

Through this discussion, we can determine that there is an efficient growth in embedded system of various real time applications. These applications come under IoT concept. Most of the embedded applications are deals with communication technique of processing through the microprocessor and microcontroller. Hence, this paper provide aware of different real time applications developed for traffic congestion monitoring and control system.

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