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Architectural Model Prediction to Provide Emergent Ambulance Services Using Wireless Enabled Services

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ABSTRACT

Ambulance services is one of the most important and integral part of every human being as it is the lifesaving component for them. However, it helps the patients only when it reached the place at the right time. Being a busy place to live in where people find less time to have control or care over their health, it is not easily possible to inform the ambulance immediately for any emergency services. Many Mortalities happen due to lack of awareness of health issues inside the body and also based on careless attitude in spending time for health related activities of the day. Many times, Old aged and middle aged people dies because of lack of care from their children. Since they are left alone, they are left in stress and it leads to sudden severe health problem where they couldn't contact even the ambulance in time which leads to death without anyone's help. Hence in this research, a proposed model is designed which is an architecture based on Wireless Intelligent Sensors that detects sudden raise or loss of blood pressure, blood sugar or any abnormal changes in the human body. In case if the problem is medium, it call for help from the patients relatives by automatically calling their emergency telephone numbers. In case if the person faints down, the blood pressure and appetite level goes down. It is automatically detected by the sensors and a call is made to the ambulance services for immediate treatment. This type of architecture of wireless intelligent sensors will provide life giving and lifesaving mechanism for the future generation as well. The Simulink model predictor is created in MATLAB and implemented without the chipset. The Model can be a boon for providing emergent services using wireless sensors in the future.

Keywords:- Ambulance emergent services, architecture model, medical parameters, wireless intelligent sensors.

I. INTRODUCTION

The major objective of the research is to propose a model that will help ambulance services to detect a patient's health factor using wireless sensors and zigbee based detection methods to save the life of human beings in time. The proposed architectural model is presented as an initiative to give solution for the problem that needs to be addressed. In recent years an efficient design of a Wireless Sensor Network has become a leading area of research. A Sensor is a device that responds and detects some type of input from both the physical or environmental conditions, such as pressure, heat, light, etc. The output of the sensor is generally an electrical signal that is transmitted to a controller for further processing. Wireless Sensor Networks (WSNs) can be defined as a self-configured and infrastructure-less wireless networks to monitor physical or environmental conditions, such as temperature, sound, vibration, pressure, motion or pollutants and to cooperatively pass their data through the network to a main location or sink where the data can be observed and analysed.

WSN is a wireless network that consists of base stations and numbers of nodes (wireless sensors).These networks are used to monitor physical or environmental conditions like sound, pressure, temperature and co-operatively pass data through the network to a main location.

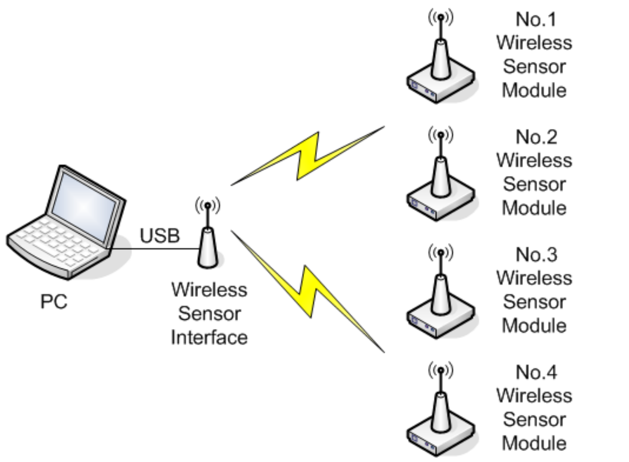

Figure 1: Wireless Sensor for Ambulance Model

Wireless sensor networks used for typical purposes like event monitoring, fault detection, measuring humidity etc. employ large number of sensor nodes. The sensor nodes are responsible for sensing and processing to some extent as well.

A sensor node is made up of four basic components:

1.1 Sensing Unit

It is usually composed of two subunits: sensors and Analog-to-Digital convertors (ADC's).

Analog signals produced by sensors based on observed phenomenon are converted to digital signals by ADC, and then fed into processing unit.

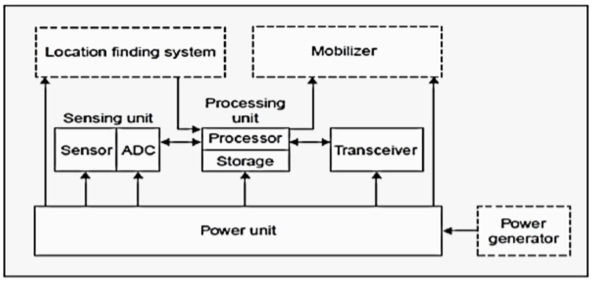

Figure 2: Components of Emergent Ambulance detection model

1.2 Processing Unit

It manages the procedures that make the sensor node collaborate with other nodes to carry out assigned sensing tasks. It is generally associated with a small storage unit.

1.3 Transceiver

It connects the node to the network.

1.4 Power Unit

Since wireless sensor networks focus more on power conservation than 'Quality of Service (QoS)', it is one of the most important components of a sensing node.

II. REVIEW OF LITERATURE

This Literature review is an assessment report on information found in the literature related to this research work for proposing a model to analyse and find a solution for emergent call of ambulance during heart problems and physical emergency. These reviews help us to describe, summarize, evaluate, substantiate and clarify the literature. This gives a theoretical base for the research and helps the authors to determine the nature of the research and it acts as a road map. The Literature survey of this research proposal inculcates current status of research along with different methodologies used, its findings from various authors with substantial outputs and results.

[1] M J Clark, G FitzGerald et.al investigated the use of emergency and non-urgent ambulance transport services by people aged 65 years and over. **SETTING:** The study was undertaken in Queensland where the Queensland Ambulance Services (QAS) is the sole provider of emergency pre-hospital and non-urgent ambulance services for the entire state. **METHODS:** The age and sex of 351,000 emergency and non-urgent cases treated and transported by the QAS from July 1995 to June 1996 were analysed. **RESULTS:** People aged 65 years and over who comprise 12% of the population utilise approximately one third of the emergency and two thirds of the non-urgent ambulance resources provided in Queensland. While the absolute number of occasions of service for females for emergency services is higher than for males, when the data are stratified for age and sex, males have higher rates of emergency ambulance service utilisation than females across every age group, and particularly in older age groups.

[2] E. S. Savas et.al reported here has translated this concept into practical results in a vital area of public service. This is a small but significant advance, of potential value to urban governments everywhere. Computer simulation was used to analyze the possible improvements in ambulance service that would result from proposed changes in the number and location of ambulances. The cost-effectiveness of several alternatives was examined. A particular alternative was shown to be of considerable value and it was concluded that low-cost improvements in service could indeed be achieved by redistributing ambulances in accordance with this alternative. This marks the first time that the City of New York has utilized computer simulation as an aid to decision-making. In addition, this represents another step in the move to use computers more creatively in municipal management. More generally speaking, the notion of applying the "space-age methods" of systems analysis, operations research, cost-effectiveness analysis, etc., to solve urban problems is a very popular one, frequently written about, discussed, and presented at conferences.

[3] Judy A Lowthian et.al measured the growth in emergency ambulance use across metropolitan Melbourne since 1995, to measure the impact of population growth and ageing on these services, and to forecast demand for these services in 2015. A population-based retrospective analysis of Ambulance Victoria's metropolitan emergency ambulance transportation data for the period from financial year 1994–95 to 2007–08, and modelling of demand in the financial year 2014–15. Numbers and rates of emergency ambulance transportations. The crude annual rate of emergency transportations across all age groups increased from 32 per 1000 people in 1994–95 to 58 per 1000 people in 2007–08. The rate of transportation for all ages increased by 75% (95% CI, 62%–89%) over the 14-year study period, representing an average annual growth rate of 4.8% (95% CI, 4.3%–5.3%) beyond that explained by demographic changes. Patients aged $\geq$ 85 years were eight times (incident rate ratio, 7.9 [95% CI, 7.6–8.3]) as likely to be transported as those aged 45–69 years over this period. Forecast models

suggest that the number of transportations will increase by 46%–69% between 2007–08 and 2014–15, disproportionately driven by increasing usage by patients aged ≥ 85 years.

[4] Tom Sterud et.al systematically explores the literature on health problems and work-related and individual health predictors in the ambulance services. We identified the relevant empirical literature by searching several electronic databases including Medline, EMBASE, PsychINFO, CINAHL, and ISI Web of Science. Other relevant sources were identified through reference lists and other relevant studies known by the research group. Forty-nine studies are included in this review. Our analysis shows that ambulance workers have a higher standardized mortality rate, higher level of fatal accidents, higher level of accident injuries and a higher standardized early retirement on medical grounds than the general working population and workers in other health occupations. Ambulance workers also seem to have more musculoskeletal problems than the general population. These conclusions are preliminary at present because each is based on a single study. More studies have addressed mental health problems. The prevalence of post-traumatic stress symptom caseness was > 20% in five of seven studies, and similarly high prevalence rates were reported for anxiety and general psychopathology in four of five studies. However, it is unclear whether ambulance personnel suffer from more mental health problems than the general working population.

[5] MDGrahamNichol et.al stated that more than 1,000 patients experience sudden cardiac arrest each day. Treatment for this includes cardiopulmonary resuscitation (CPR_ and emergency medical services (EMS) that provide CPR-basic life support (BLS), BLS with defibrillation (BLS-D), or advanced life support (ALS). Our previous systematic review of treatments for sudden cardiac arrest was limited by suboptimal data. Since then, debate has increased about whether bystander CPR is effective or whether attention should focus instead on rapid defibrillation. Therefore a cumulative meta-analysis was conducted to determine the relative effectiveness of differences in the defibrillation response time interval, proportion of bystander CPR, and type of EMS system on survival after out-of-hospital cardiac arrest.

Hence it's the need for the researcher to identify a best model that can indicate ambulance services at ease to save the life of people and improve the medical services to the public.

III. ARCHITECTURAL MODEL FOR AMBULANCE EMERGENT PREDICTION

Ambulance Services is one of the lifesaving system for old people and helps people who are lonely and need someone to help their life can utilize this architecture model. Some of the Objectives of the system are given below:

1) To create medical history of the patients and also to create a profile for every one of them.
2) To manipulate the medical need and alerts for every patient and give alert to the ambulance based on the emergency need.

The Architecture of the proposed model implemented in the research is presented below:

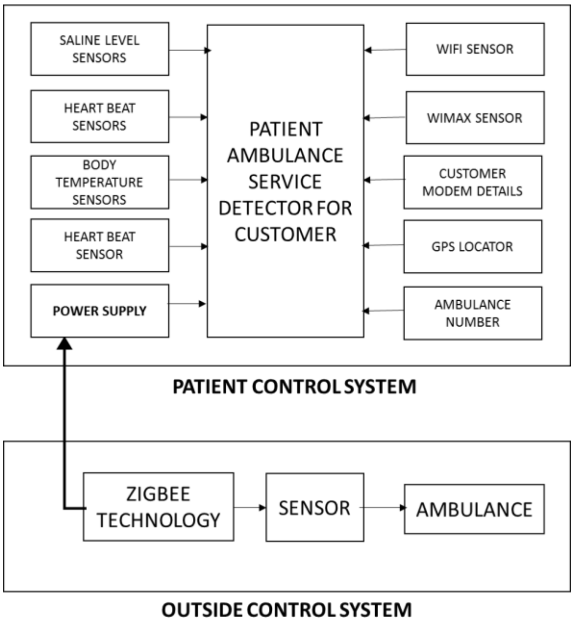

Figure 3: Proposed Model for Ambulance detection for Emergency

Based on the requirements to frame the model, the proposed system consists of four major sensors:

1. Body Temperature sensor,
2. Heart rate Sensor,
3. Brain Senses sensor and
4. Salt level sensor.

The system consists of an infrared (IR) LED as transmitter and an IR photo-transistor as a receiver that acts as a fingertip sensor. The sensor consists of a super bright red LED and light detector. The LED needs to be super bright as the maximum light must pass spread in finger and detected by detector. Now, when the heart pumps a pulse of blood through the blood vessels, the finger becomes slightly more opaque and so less light reached the detector. With each heart pulse the detector signal varies. This variation is converted to electrical pulse. This signal is amplified through an amplifier which outputs analog voltage between 0 to 5V logic level signal.

Fainting is most commonly caused by a temporary glitch in the autonomic nervous system. This is sometimes known as neutrally mediated syncope. The autonomic nervous system is made up of the brain, nerves and spinal cord. It regulates automatic bodily functions, such as heart rate and blood pressure. An external trigger can temporarily cause the autonomic nervous system to stop working properly, resulting in a fall in blood pressure and fainting. The trigger may also cause your heartbeat to slow down or pause for a few seconds, resulting in a temporary interruption to the brain's blood supply. This is called vasovagal syncope.

Fainting can also be caused by a fall in blood pressure when you stand up. This is called orthostatic hypotension, and tends to affect older people, particularly those aged over 65. It's a common cause of falls in older people. When you stand up after sitting or lying down, gravity pulls blood down into your legs, which reduces your blood pressure. The nervous system usually counteracts this by making your heart beat faster and narrowing your blood vessels. This stabilises your blood pressure. However, in cases of orthostatic hypotension, this doesn't happen, leading to the brain's blood supply being interrupted and causing you to faint.

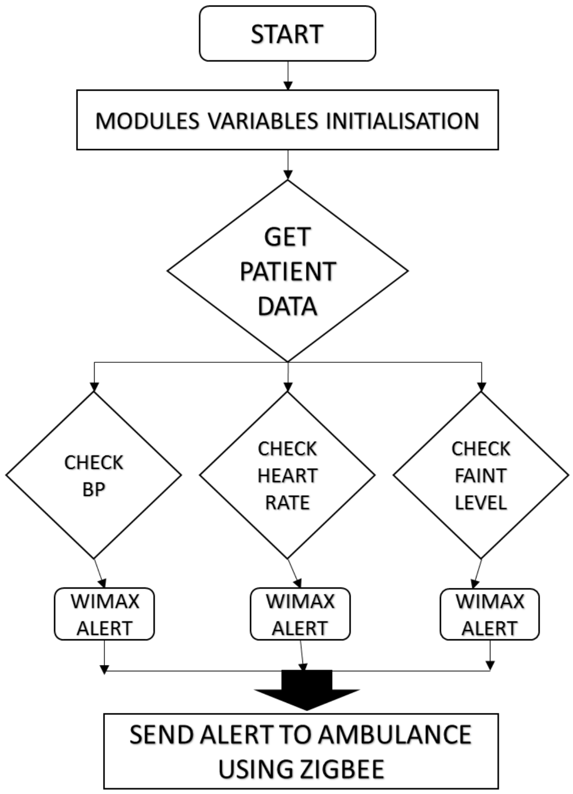

Figure 4: Algorithm for Control System Design

Thus all these circumstances are considered for evaluating the stability of a person and identify the occurrence of any change in the blood pressure level and alert the patient before they get fainted. Some patients gets a sudden upliftment of nerves which leads to fainting due to loss of senses. This is also observed through wireless sensors. In the initial stage, the Zigbee sensors may be attached to patient's body and sensed for any abnormal changes in the body conditions.

IV. IMPLEMENTATION IN MATLAB

To complete the implementation of this model with a preferred architecture, a simulative and model oriented designing environment called Simulink is chosen for creating artificial system with embedded code for implementation of Wireless sensors identification for ambulance services. In Matlab, Simulink is a part where graphical tools of circuits and components are used to model, simulate and identify the solution along with a proposed architectural model. In general, Simulink is just a diagrammatic tool which can inform the creators to create effective output using devices in the future.

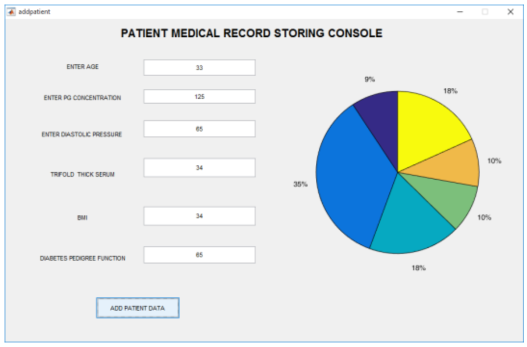

Figure 5: Patient information creation in MATLAB

The implementation part begins with acceptance of patient information in the database and recording it.

The Results of the patient information system portray that the alert services with ambulance using major health factors can help them to save the life of a human. It also predicts the future that all alert services can be easily presented using upcoming Wireless technologies and bring good results for the society. The model is designed and presented using Simulink component in MATLAB with the inbuilt tools and resources. The model design is presented below:

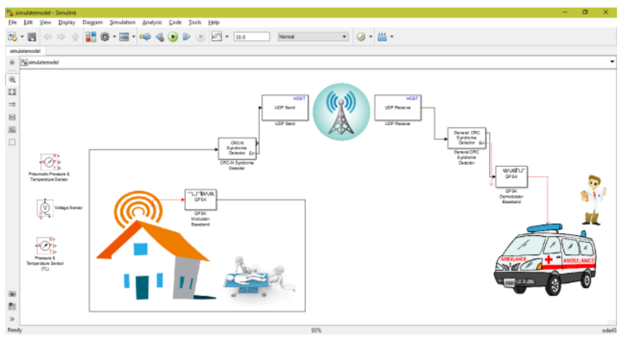

Figure 6: Simulink Model for Emergent Ambulance Services for Old Patients

Thus this model is a new innovation in developing countries where emergent medical services is always a dream. It can save thousands of lives at the highest rate.

V. ADVANTAGES OF THE MODEL

The proposed model has its merits and demerits that is destined for the effective functioning of this research. They are

[1] It provides seamless support for helpless patients to make immediate call to the ambulance using wireless services.

[2] It promotes self-analysis and self-support for people to not to depend on any one for calling ambulance services.

[3] The design and model can be highly implemented in any software and the methodology is recommended under all strategies.

The only demerit is

[1] It is of High Cost and only presented in model level. It needs to be implemented in circuit and embedded in chip by engineering graduates in future.

VI. CONCLUSIONS

This research is a new dimension for medical and hospital based ambulance services to track the emergent medical requirements easily and reach the patients in time. Even a span of 10 minutes

The proposed system can address such situations by routing data in real-time from a patient’s home to a website database where the data can be accessed by his physician without any time lag. In this case, any dangerous situation can be avoided because the technology will generate an alarm to alert the physician rather than requiring the patient to inform his physician of the situation. Such systems, however, will need an alternate means to power router nodes within the household since solar energy harvesting would not be a viable option. Energy scavenging through piezoelectric vibration generators might be a practical solution for powering router nodes in such applications and will be explored by the authors in the near future.

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