IoT Based Military Assistance and Surveillance

Conference Paper · April 2018

DOI: 10.1109/ICICS.2018.00076

2 authors, including:

Swapnil Bagwari
Lovely Professional University
4 PUBLICATIONS **1** CITATION

SEE PROFILE

IOT BASED MILITARY ASSISTANCE AND SURVEILLANCE

P.Raja
Electronics and Communication Engg.,
Lovely Professional University
Jalandhar, Punjab, India
rajsella.visys@gmail.com

Swapnil Bagwari
Electronics and Communication Engg.,
Lovely Professional University
Jalandhar, Punjab, India
sbagwari@gmail.com

Abstract - **A long way from home and friends and family, these saints forfeit their own lives so the whole country can rest in peace. Military Assistance and Surveillance System (MASS) can get a sensational effect on troopers making the country more secured. This framework is joins a few propelled highlights that could spare the lives of fighters in mission basic situations. MASS is intended to incorporate data obtaining and preparing to upgrade summon and control of a military unit. Advances in this model incorporate a land data framework, Multi sensor information combination framework, figuring gadgets and IoT-based correspondence framework for troopers. Once completely created and demonstrated, MASS will be basic components of the Army's system driven fighting project and will connect infantry level troops on the front line to the summon base camp. It will likewise arrange ground troops with the different Army order central command and incorporate all components in a fight gathering, giving constant strategic situations. MASS will have the capacity to get and transmit information, for example, land data and sensor information including air conditions, wellbeing status and messages enabling the officers to get to the ongoing data at the same time with the summon home office.**

Keywords— Surveillance, Wireless sensor networks, Energy efficiency, Schedules, Military communication, Security.

I. INTRODUCTION

Military Assistance and Surveillance System is a concept model of an IOT based wearable device for military purposes. This idea can fulfill several use cases in the military. MASS is likewise an upgraded adaptation of Battlefield Management System – BMS (a framework intended to incorporate data securing and preparing to improve order and control of a military unit). This framework additionally underpins the popular IKC2 Movement (Integrated Knowledge based Command and Control), a framework intended to incorporate data securing and preparing to upgrade order and control of a military unit.

MASS makes it easy for the soldiers to know several parameters such as their location, surrounding conditions, health conditions, sending messages to base station, etc. it provides a simple to use interface .they can get assistance from the base through the wearable device and at the same time a log is created about those parameters which is the main function of Military Assistance and Surveillance System.

MASS makes it easy for the soldiers to know several parameters such as their location, surrounding conditions, health conditions, sending messages to base station, etc. it provides a simple to use interface .they can get assistance from the base through the wearable device and at the same time a log is created about those parameters which is the main function of System Military Assistance and Surveillance System.

The ongoing human body location is basic for different fields like home security frameworks, observation frameworks, correspondence frameworks and more [1]. Basically the reconnaissance frameworks are developing with various cameras which are set in various edges of view to track human items [2].

The progression of the cutting edge Internet of Things (IoT) makes the probability of interfacing PC automated control structures for remote watching and brisk reaction to occasions requiring continuous taking care of [4]. Previously, an offices supervisor needed to physically take care of a control framework regularly making a postponement in real life prompting harms [5].

Features of MASS

- A bright color display at the wearable which enables soldiers to view it even in sunlight.
- Temperature and humidity detection.
- Flammability index and Air Quality monitoring.
- Heart rate of the soldier.
- Predefined messages and an easy to use interface for sending messages to the base station.
- Hands free Gesture control feature in order to control servo motor gimbal.
- Sensing RGB Values.
- Interactive IoT client at base station.

978-1-5386-6483-4/18/$31.00 ©2018 IEEE
DOI 10.1109/ICICS.2018.00076

Internet of Things:

The Internet of Things (IoT) alludes to the system of physical gadgets that highlights an IP address for web availability, and the correspondence between those articles and other Internet-empowered gadgets and frameworks. The IoT enables items to detect or control remotely crosswise over existing system foundation, making open doors for more straightforward joining of the physical world into PC based frameworks, bringing about enhanced effectiveness, precision, low inertness, monetary advantage notwithstanding lessened human mediation.

Figure 1: Internet of Things

II. SYSTEM OVERVIEW

Our idea was to create a wearable device to provide assistance to military soldiers and also to enable information acquisition from his context. For a wearable device, the main component is display. Our initial thought was to use a regularly available 20X4 LCD, but we shelved it as found it too big for a wearable device. So we have searched for alternative displays in the market and we have bought this S6D02A1 Display.

In order to implement IoT, We have researched and found several options like adafruit.io and Things peak but these cloud services do not allow GPS Data to be displayed. At last, we have found Ubidots. Ubidots makes it possible to display GPS Data on Map and its interactive widgets and option to allow Geo fencing is what our system needs. Ubidots allows only Node MCU V1.0 under esp8266 family. So instead of using esp8266 straightforward, we have used Node MCU for our system. Node MCU is the master device.

To detect smoke and other flammable gases, we have used MQ5 gas sensor and to detect air quality index, we have used MQ135 gas sensors. These are widely available and easy to use modules with easy to use interface. To detect heart rate, there are two options. One is Keyes heart rate sensor and other one is pulse sensor Amped. The former sensor is a normal sensor which calculates heart rate after desired intervals whereas pulse sensor is based on interrupts and is comparatively more accurate.so, we have opted for Pulse sensor amped for our system. In order to detect Humidity and temperature, we have used DHT11 as it can fulfill the purpose of finding both humidity and temperature. Unlike gas sensors, this module works on a single wire interface.

Initially, idea was to use gestures in order to control the camera fitted onto the servo. But using traditional techniques such as accelerometer and flex will not fulfill the purpose in the military as they are not stationary during the course. So, we have decided to use Touch less gestures which are provided by APDS990. This module will also provide other features such as RGB, ambient light and proximity detection.

As said before, the rundown of IoT applications is perpetual in business and mechanical activities. In the field of wellbeing has been no special case. Because of the IoT innovation you get the flexibility to associate with anybody, whenever, anyplace [6], with the motivation behind get quicker diagnostics and expectations. We could state that IoT innovation could be updating the current medicinal services administration, at any rate in common society [7]. In this sense, we can state that military wellbeing is even more basic and complex, particularly when there are fighters associated with high-chance battle tasks, where medicinal care is extremely restricted and there is a basic need to watch over each fighter in the mission.

III. HARDWARE DESIGN AND IMPLEMENTATION

Since Node MCU is new arrival in the market, we have faced several challenges while programming .some challenges are hardware based and some challenges are software based. Due to the limitation of analog pins in Node MCU, an Arduino Nano is being used in parallel to the Node MCU which communicates through Hardware Serial Port.

Since Arduino Nano works on +5V and Node MCU works at +5V, a direct connection between them may fry the NodeMCU.in order to prevent this; a Bidirectional Logic Level shifter is used. This module has four channels. Since there are only two lines connected, we need two channels. We have used channel 1 (LV1, HV1) and Channel 2(LV2, HV2). Since Node MCU is new arrival in the market, we have faced several challenges while programming .some challenges are hardware based and some challenges are software based.

Due to the limitation of analog pins in Node MCU, an Arduino Nano is being used in parallel to the Node MCU which communicates through Hardware Serial Port. Since Arduino Nano works on +5V and Node MCU works at +5V, a direct connection between them may fry the NodeMCU.in order to prevent this, a Bidirectional Logic Level shifter is used. This module has four channels. Since there are only two lines connected, we need two channels. We have used channel 1 (LV1, HV1) and Channel 2(LV2, HV2).

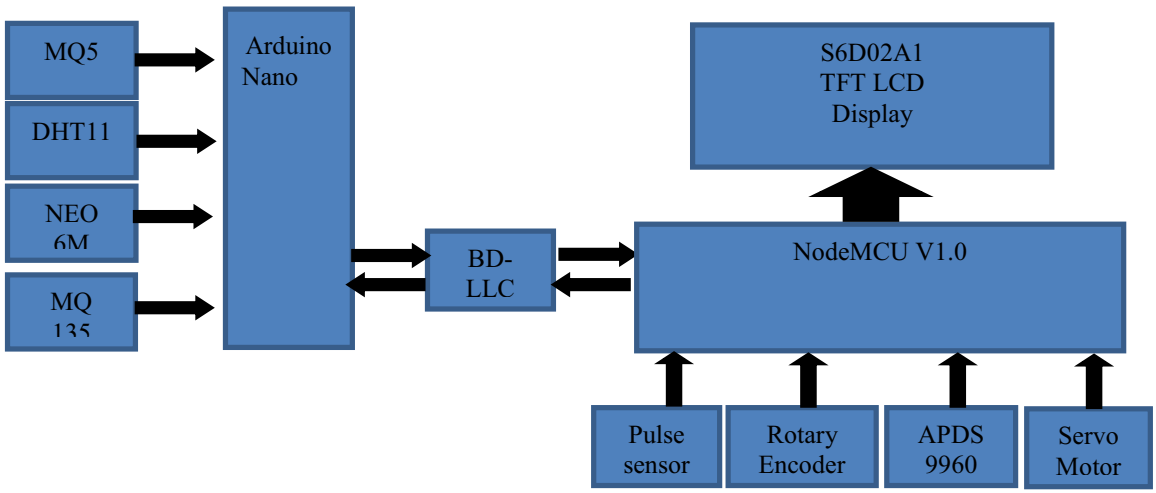

Figure 2: Block Diagram of System

The library we are using for DHT11 sensor is based on software interrupts. Pulse sensor also works on the software interrupt. Due to this situation, they are not working in conjunction. There are five devices that are using interrupts (hardware and software based). Also SPI will not allow running any kind of interrupts while it is running. In order to prevent this situation, we have used daisy chain methodology where at a time only one device interrupt has command over the system and we are able to solve this problem for all sensors except for DHT11 sensor. So, we have interfaced DHT11 on Arduino Nano side and transmitted the data to Node MCU through Hardware serial port.

The GPS module that we are using has a passive antenna. This cannot be used indoors. In order to prevent this, we are publishing data to Ubidots through a mobile app as mobile phones have active antennas. Several other minor challenges have been resolved by brainstorming.

The Atmel 8-bit AVR RISC based microcontroller consolidates 32 kB ISP Flash memory with read-while-compose capacities, 1 kB EEPROM, 2 kB SRAM, 23 universally useful I/O lines, 32 broadly useful working registers, three adaptable clock/counters with look at modes, inside and outside interferes with, serial programmable USART, a byte-situated 2-wire serial interface, SPI serial port, 6-channel 10-bit A/D converter, programmable guard dog clock with inner oscillator, and five programming selectable power sparing modes.

NodeMCU

NodeMCU is an open source IoT stage. It incorporates firmware which keeps running on the ESP8266 Wi-Fi SoC from Espressif Systems, and equipment which depends on the ESP-12 module. The expression "NodeMCU" of course alludes to the firmware instead of the engineer packs.

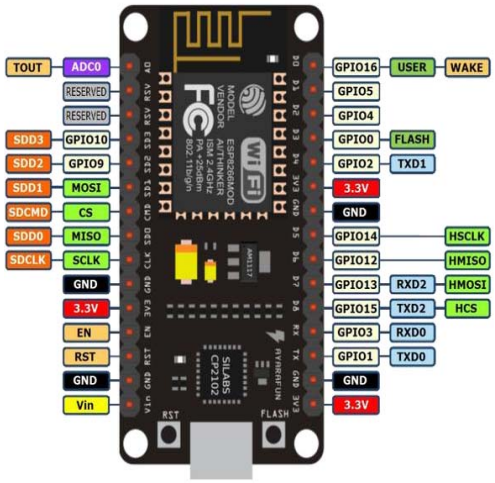

Figure 3: Pin Configuration of Node MCU

The NodeMCU board V1.0 depends on an ESP8266-12E yet includes an inherent serial over USB interface and different pleasantries like 2 catches and 2 LEDs. The board is smaller and fits on a breadboard. It has 11 GPIO of which anybody can fill in as I2C/PWM/TWI interface.

Gesture detection using APDS9960

This system also uses gesture detection feature of APDS9960 in order to control the camera connected to a 2-axis servo gimbal placed atop helmet in order to enable the solider to view in any orthogonal directions.

Gesture sensor has four separate photodiodes which are sensitive to different directions and they get activated in a different pattern upon each gesture. An internal gesture engine calculates the speed, direction and proximity of objects nearby. As only one gesture is to be processed by the sensor and microcontroller at a time, sensor provides a low to high pulse at the interrupt pin (INT). That interrupt has to be processed by the microcontroller so that upon every low to high pulse, a gesture is read by the microcontroller.

Pulse oximetry is the method whereas photoplethysmograph is the measurement

At the point when the heart directs blood through the body, with each beat there is a heartbeat wave (sort of like a stun wave) that movement along all conduits to the very furthest points of fine tissue where the Pulse Sensor is appended. Genuine blood flows in the body much slower than the beat wave voyages. How about we take after occasions as they advance from point 'T' on the PPG beneath. A fast upward ascent in flag esteem happens as the beat wave goes under the sensor; at that point the flag falls down toward the typical point. In some cases, the dichroic score (descending spike) is more articulated than others, yet for the most part the flag settles down to foundation clamor before the following heartbeat wave washes through. Since the wave is rehashing and unsurprising, we could pick any conspicuous element as a kind of perspective point, say the pinnacle, and measure the heart rate by doing math on the time between each pinnacle. This, be that as it may, can keep running into false readings from the dichroic score, if exhibit, and might be helpless to error from gauge commotion too. There are other great reasons not to construct the beat-discovering calculation with respect to subjective wave marvels. In a perfect world, we need to locate the immediate snapshot of the pulse. This is critical for exact BPM figuring, Heart Rate Variability (HRV) studies, and Pulse Transit Time (PTT) estimation. There are several parameters to be calculated or considered in order to calculate the heartbeat.

Table 1: Descriptive information about several variables to be found using pulse sensor

Variable name	**Full form**	**Refresh beat**	**Description**
Signal	NA	2ms	Raw pulse sensor signal
BPM	Beats per minute	Every beat	Time between heartbeat in ms
IBI	Inter Beat interval	Every beat	Beats per minute
QS	Quantified self	Set true every beat	Must be cleared by user
Pulse	NA	Set true every beat	Cleared by ISR

IV. RESULT AND DISCUSSION

System MASS is developed with very low cost and easily available electronic sensors and Development Boards. Climatic conditions like temperature, level of harmful gases around the soldier are sensed and displayed on the TFT Screen and also sent to Command Base which is displayed on Ubidots Dashboard in real-time. Health conditions of soldier such as heart rate is sent to the Ubidots Cloud in real time and also displayed on the TFT LCD. An easy to use interface is provided to enable the soldiers to send the predefined messages quickly using Rotary encoder.

Figure 4: Display showing sensor data

Using GPS Module, Location of the soldier is sent to Military Base and also shown on the TFT Display. Touch less gestures is provided in order to enable the soldier to easily rotate the camera towards any of the supported direction through his wearable.

V. CONCLUSION AND FUTURE SCOPE

In this paper IoT Based Military assistance and surveillance system on wearable is presented. This system is implemented to find an effective solution for the problems faced by soldiers System MASS is a wearable specially designed for soldiers which helps them on the battlefield once fully developed and proved; System MASS will be critical elements of the Army's network-centric warfare program and will link infantry level troops on the battlefield to the command headquarters. It will also network ground troops with the various Army command headquarters and integrate all elements in a battle group, providing real time tactical scenarios. System MASS will be able to receive and transmit data, such as geographical information and sensor data including atmospheric conditions, health status and messages allowing the soldiers to access the real time information simultaneously with the command headquarters.

On the helmet is any transparent display that presents data without requiring users to look away from their usual viewpoints. Image, location and surrounding are processed with Marker less AR. This feature is enabled with the help of 360 degree camera placed on the helmet of soldier. Guns can be operated only by authentication of authentic soldier using RFID and the ammunition status is shown with the help of counter which is attached to the gun. Holograms are realistic, moving three-dimensional images on military wearable for better display of interactive information to the soldiers.

REFERENCES

[1] Ghanem Osman Elhaj Abdalla, T. Veeramanikandasamy, Implementation of Spy Robot for A Surveillance System using Internet Protocol of Raspberry Pi, on Recent Trends In Electronics Information & Communication Technology May 19-20, 2017, India.

[2] Jennifer Sander, Frank Reinert, A Computer-Aided Assistance System for Resource-Optimal Sensor Scheduling in Intelligence, Surveillance, and Reconnaissance on Multi sensor Fusion and Integration for Intelligent Systems (MFI) Kongresshaus Baden-Baden, Germany, Sep. 19-21, 2016.

[3] Frank Reinert, Jennifer Sander, Supporting Sensor Scheduling in Intelligence on ICICCS 2017.

[4] Syed Ali Imran Quadri, P.Sathish, *IoT Based Home Automation and Surveillance System on* International Conference on Intelligent Computing and Control Systems ICICCS 2017.

[5] Rickin Patel, Vipul K. Dabhi, Harshadkumar B. Prajapati, A Survey on IoT based Road Traffic Surveillance and Accident Detection System (A smart way to handle traffic and concerned problems) on International Conference on Innovations in Power and Advanced Computing Technologies [i-PACT2017]

[6] Rolando P. Reyes Ch, Manolo Paredes Calder´on, Luis Montoya, MilNova: An Approach to the IoT Solution based on Model-Driven Engineering for the Military Health Monitoring in CCNC, 2015.

[7] Mr.Chaitanya Vijaykumar Mahamuni, A Military Surveillance System based on Wireless Sensor Networks with Extended Coverage Life on 2016 International Conference on Global Trends in Signal Processing, Information Computing and Communication.

[8] Liang Cao, Guo Zheng, Yong Shen, Research on Design of Military Ammunition Container Monitoring System Based on IoT on 2016 Prognostics and System Health Management Conference (PHM-Chengdu) 978-1-5090-2778-1/16/$31.00 ©2016 IEEE.