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Video Transmission Over Wireless Networks For Energy Aware And Adaptive Switching Transmission

Mr. Mohammad Amzad
Student of M.TECH (ES)
S R Engineering College, Warangal, India.

Ms. N. Shilpa
Assistant Professor in ECE
S R Engineering College, Warangal, India.

Abstract

Wireless multimedia sensor networks (WMSNs) is an ad hoc network of wirelessly connected sensor nodes that allow retrieving video and audio streams, still images, and scalar sensor data but such sensors are limited in energy, memory, communication, and computational power. Multimedia transmission over wireless sensor networks (WSN) is challenging task due to quality of service (QoS) guarantees such as huge amount of bandwidth, strict delay, and lower loss ratio. Recently, cross layer approach adopted by WMSNs shows a promising approach that improves quality of multimedia transmitted over WSNs under different wireless conditions. In this paper, an energy aware and adaptive cross layer scheme to transmit multimedia content over WSNs is presented. It provides packet, queue and path scheduling, so that it selects optimal video encoding parameters at application layer according to current to current wireless channel state, and schedules packets according to it's through an adaptive priority video queue so that less important packets are dropped in case of network congestion. Finally, Path scheduling is introduced so that different packets type priorities are routed through different paths with different QoSs considering network lifetime. A simulation result show that new scheme transits video over WSNs efficiently and meets QoS requirements and uses energy wisely to prolongs network lifetime.

Keywords: Wireless multimedia sensor networks (WMSNs), Quality of service (QoS), and Computational Power

I. INTRODUCTION

Multimedia over WSN is a service that integrates voice, video and data in the same service. For example songs, movies, games are considered to be different forms of multimedia. Transferring such data over WSN may lead to network congestion. To avoid this situation, a split and transfer technique is emphasized in this project. Wireless multimedia sensor networks (WMSNs), is an ad hoc network of wirelessly connected sensor nodes that allow retrieving video and audio streams, still images, and scalar sensor data but such sensors are limited in energy, memory, communication, and computational power. Multimedia transmission over wireless sensor network (WSN) is a challenging task due to quality-of-service (QoS) guarantees such as huge amount of bandwidth, strict delay, and lower loss ratio. Recently, cross-layer approach adopted by WMSNs shows a promising approach that improves quality of multimedia transmitted over WSNs under different wireless conditions. In this project, an energy aware and adaptive cross layer scheme to transmit multimedia content over WSNs is presented. It provides adaptive channel selection for optimal video encoding parameters at application layer according to current wireless channel state, and schedules transmission according to its type through an adaptive priority video queue.

II. HARDWARE COMPONENTS

A. Arduino UNO

B. Wireless modules

C. Wireless Camera

III. SOFTWARE COMPONENTS

A. Arduino IDE
B. Honstech Interface

IV. RELATED WORK

Wireless multimedia sensor networks (WMSNs), is an ad hoc network of wirelessly connected sensor nodes that allow retrieving video and audio streams, still images, and scalar sensor data but such sensors are limited in energy, memory, communication, and computational power. Multimedia transmission over wireless sensor network (WSN) is a challenging task due to quality-of-service (QoS) guarantees such as huge amount of bandwidth, strict delay, and lower loss ratio.

Path scheduling aims to establish path between source and destination node not only using optimal hop count as employed by traditional routing protocols but also using other application QoS metrics such as delay, bandwidth, loss and energy requirements, which depends on application of the WSN.

Path scheduling in limited networks such as WSNs depends on various routing metrics where paths are ranked based on congestion, hop count and interference. In a single routing metric (hop count, congestion level, bottleneck of node leisure level and the number of congested nodes) is used, in addition it assigns videos frames according to path congestion status whether to single or multipath. While in this work it selects path suitable for each packet type, where, delay-sensitive packets are routed through fastest path, while error-sensitive packets are routed through the most reliable links, and finally non-constrained packets through least energy paths. In this work a video transmission scheme which is content aware that schedules different video packets over different paths, so that high priority packets are transmitted through high quality paths. Source nodes send control messages periodically to sink node to exchange state of each routing path, and Sink node collects path status and ranks each path using (energy level, buffer status, hop count and path reliability) and reply back to source node with new path rank, so that source nodes later route packets according to its type through suitable path. Similarly uses Ants based multi-QoS routing algorithm which ranks paths using (loss ratio, available memory, queuing delay and remaining energy).

Other work apply AI technique for scoring paths, it uses link expiration time, probabilistic link reliable time, link packet error rate, link received signal strength and residual battery power to calculate score of each path using fuzzy logic. While this work uses signal strength, remaining energy and available memory to score each path, while in uses drain rate and delay for scoring path, other cross layer protocol level and free buffer space. In this work a new communication cross layer architecture is presented for video transmission overWSNs. It is called energy efficient and high quality video transmission architecture. It influences Application, Transport and Network layers of communication protocol stack by introducing new protocol for layer. Moreover, it considers sensor nodes constraints like limited energy and processing capabilities without losing video quality at the receiver side. The dropping scheme presented in this work decided to discard packets based on energy level of each node and priority information that had been provided by video compression layer inside the received packets.

In this work a new protocol called CLAR is introduced where its network layer selects optimal route based on Ad-hoc routing DSR protocol. It favors a path, which has a better value of CQI (channel quality indicator) that asses link reliability and stability in physical layer. It uses SNIR (signal to noise interference ratio) of the received signal to estimate CQI and maintains it for each neighbor node using DRMACSN MAC layer protocol. This protocol checks the of number of ongoing transmissions which maintained for each neighbor node before exchanging routing control packets to minimize energy consumption in case bad channel or simultaneous transmissions which exceeded a threshold value.

In a distortion minimization technique is introduced which used a strict energy budget through UEP (unequal error protection) approach by assigning different priority levels according to image-pixel position or value information. It is a position oriented resource allocation scheme across PHY, MAC, APP layers for image transmission

over WMSNs. It assumes that communication loss in p-data (position information) which contains structure and position information has significant effect on the overall quality of the received image than v-data (value information) which contains image pixel value information.

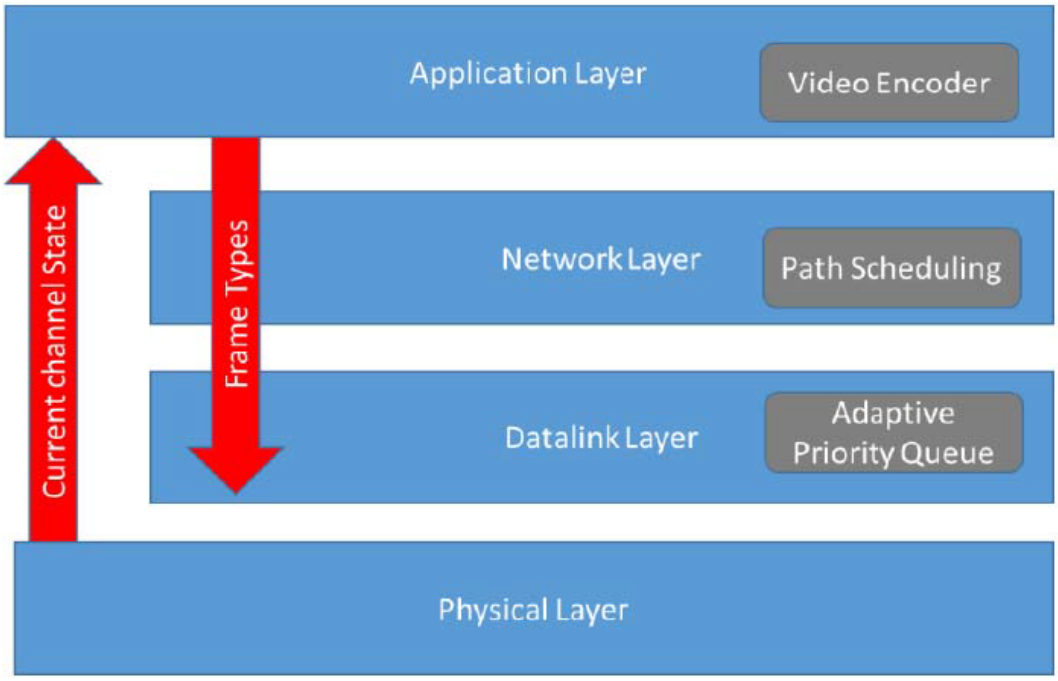


Fig. 1. Energy-aware and adaptive cross-layer scheme for video transmission over wsn packet scheduling component.

It depends on wavelets to compress image data at APP layer as it can easily separate position and value information via coding pass partition, it is noted by this work that correct decoding of p-data depends only on correct decoding of segment while correct decoding of v-data depends on successful decoding of previous p-data and v-data.

Cross layer approach was employed to maximize total distortion reduction and minimize energy consumption using optimization function which considered BER (Bit error rate), ARQ (Automatic repeat request) and data transmission rate as resources for allocation which used for transmitting each p-data and v-data segments.

While previous work focus on multimedia QoS, there are several work aim to maximize network lifetime of each node and use battery fairly to prolong time before network partitioned, it recommends to transmit data at the minimum power level to maintain links or dynamically choose transmit range of each node to minimize energy consumption. While other work balance energy usage of all mobile nodes by selecting under-utilized route other than shortest path. Other work chooses inactive communication to minimize energy consumption where some nodes are scheduled to sleep to keep minimum number of nodes awaken for transmission while others get sleep to minimize energy consumed while nodes is inactive.

In this work LESOP (Low Energy Self-Organizing Protocol) for target tracking applications in large scale wireless sensor networks deployment is presented, it employs a cross layer approach where both Application and MAC layers cooperate directly while Transport and Network layers are excluded to simplify protocol design. It introduces a new localization algorithm that considers tradeoff between energy consumption and tracking error. It is a connectionless networking protocol, which advocates consolidation of OSI layers headers and improvement of energy efficiency by excluding initial link acquisition and shared routing information. It implemented a new architecture called EWI (Embedded Wireless Interconnect) where only two layers exists, bottom wireless link layer that provides wireless transmission module to the upper system layer which exploits tradeoff between QoS and energy consumption.

As we are using Arduino Uno**.** It is a popular open-source single-board microcontroller, descendant of the open-source Wiring platform, designed to make the process of using electronics in multidisciplinary projects more accessible. The hardware consists of a simple open hardware design for the Arduino board with an Atmel AVR processor and on-board input/output support. The software consists of a standard programming language compiler and the boot loader that runs on the board. Arduino hardware is programmed using a Wiring-based language (syntax and libraries), similar to C++ with some slight simplifications and modifications, and a Processing-based integrated development environment.

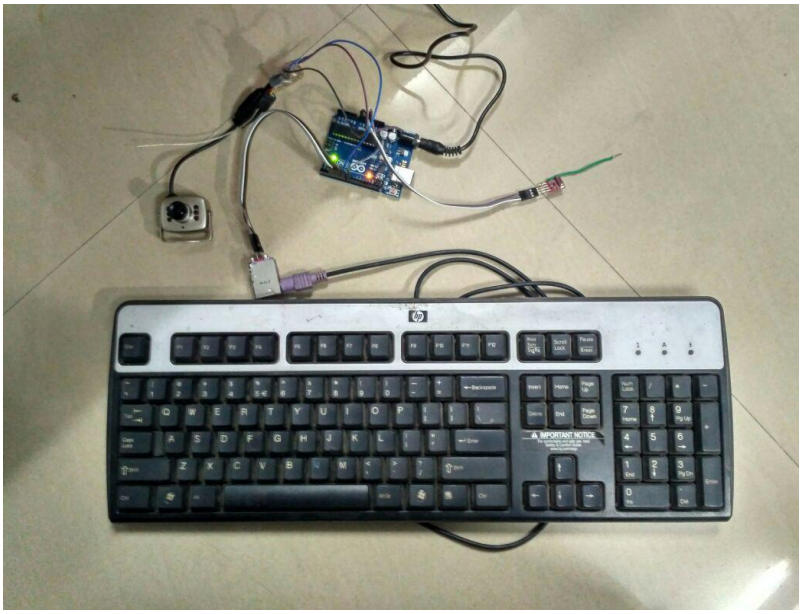
V. METHODOLOGY

Multimedia over WSN is a service that integrates voice, video and data in the same service. For example songs, movies, games are considered to be different forms of multimedia. Transferring such data over WSN may lead to network congestion. To avoid this situation, a split and transfer technique is emphasized in this project.

- In this project the Arduino is employed to separate the video signal and digital data.
- The digital data is transmitted through Digital Transponder.
- The video is transmitted through VHF Transponder.
- Network congestion is avoided by derailing the multimedia content which occupies more bandwidth from the main digital transponder.

A. Transmitter

Following figures 2, 3 are the general block diagrams of multimedia transmitter and receiver. In this diagram we are having the different blocks that are perform a particular task or function to transrecieve the multimedia data that may be video or audio.



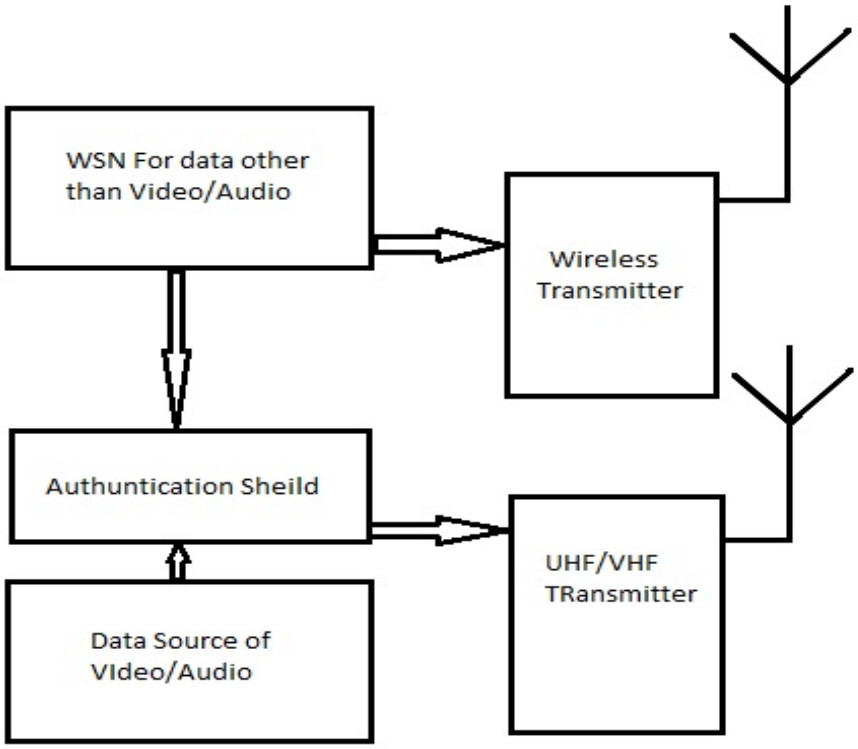
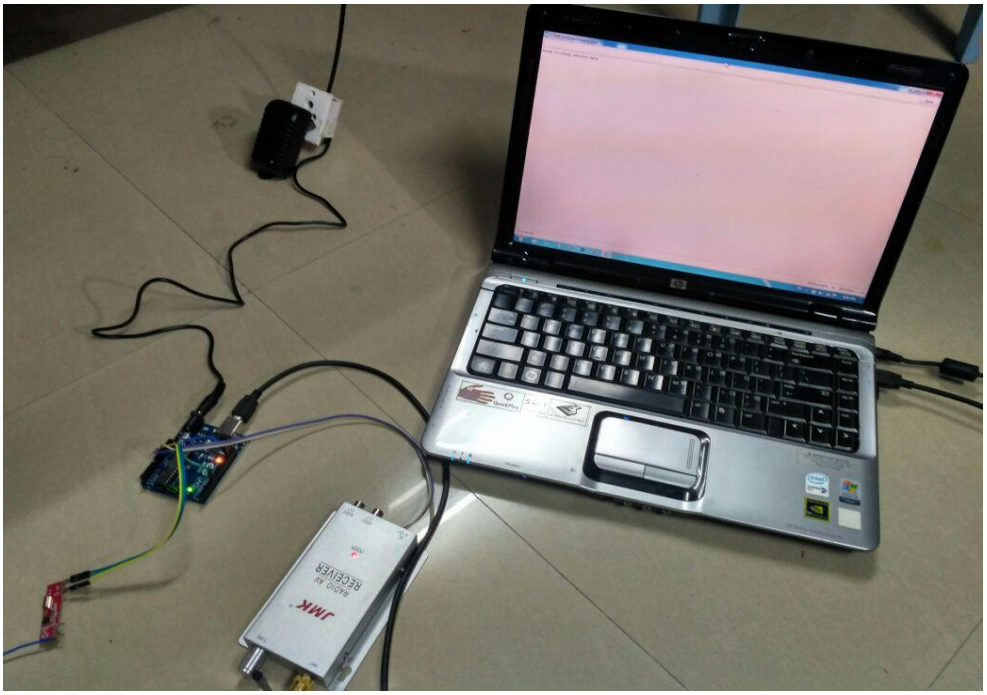


Fig2: Transmitter Block Diagram

At the transmitter side we are generating a randomly variable key that can be sent in an encrypted format with a digital form. And we can send the data in analog form attached with encrypted key.

B. Receiver

At the receiver end it receives the encrypted key and analog data that has sent by the transmitter. The key has decrypted and then the analog data can become readable.



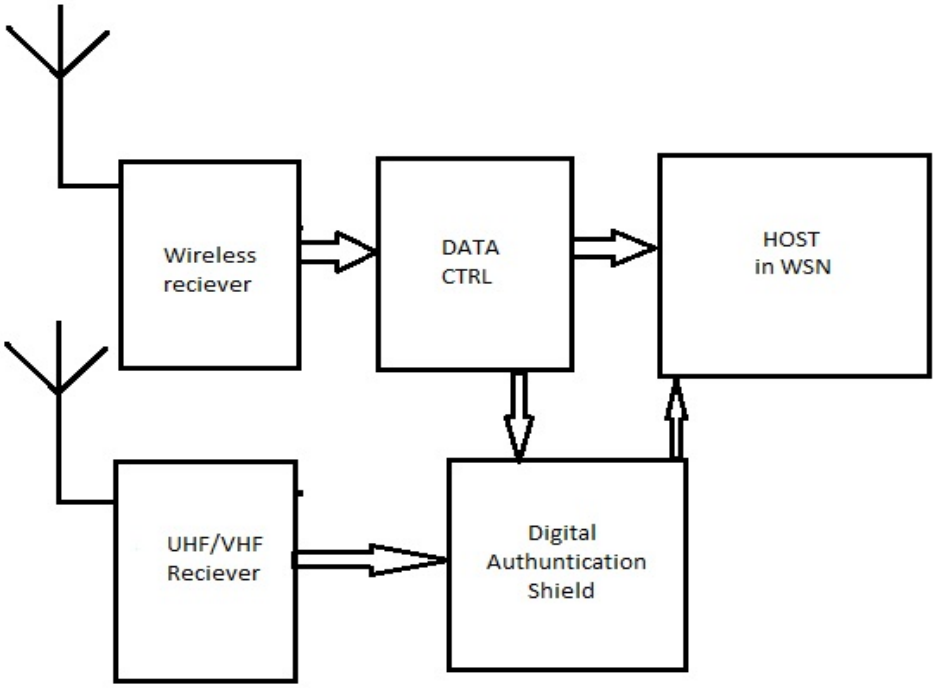
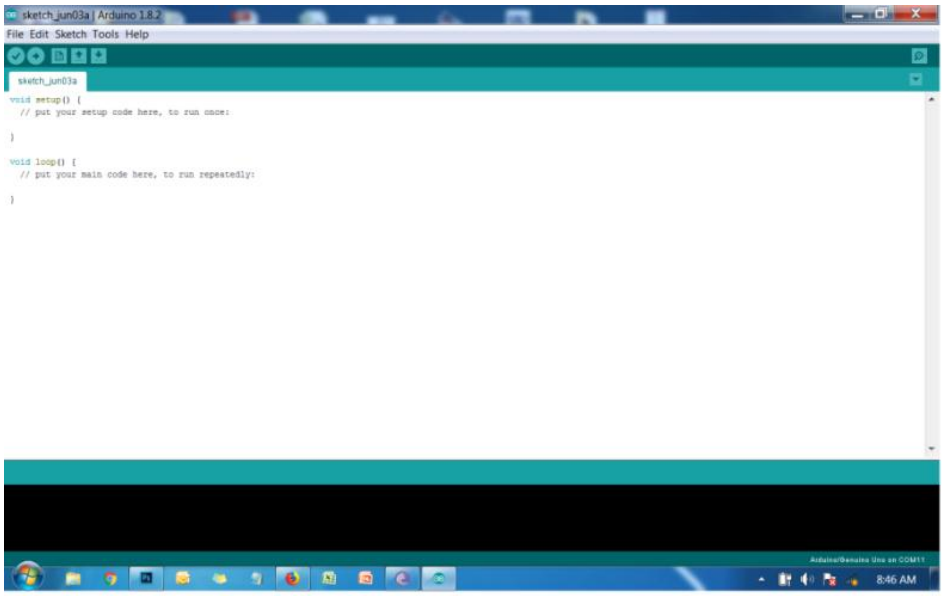


Fig3: Receiver Block Diagram

VI. PROGRAMMING WORK

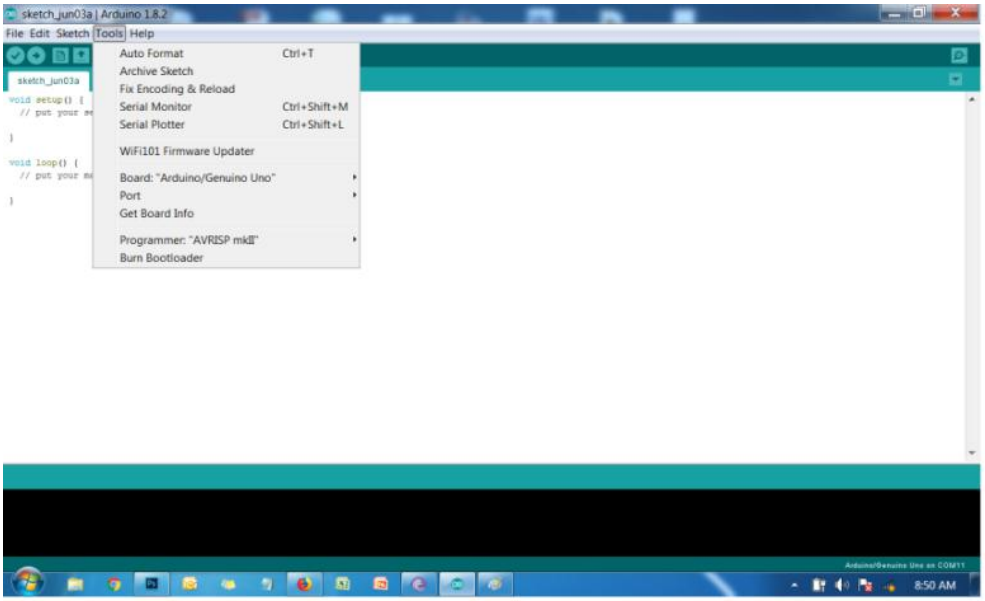
Step 1

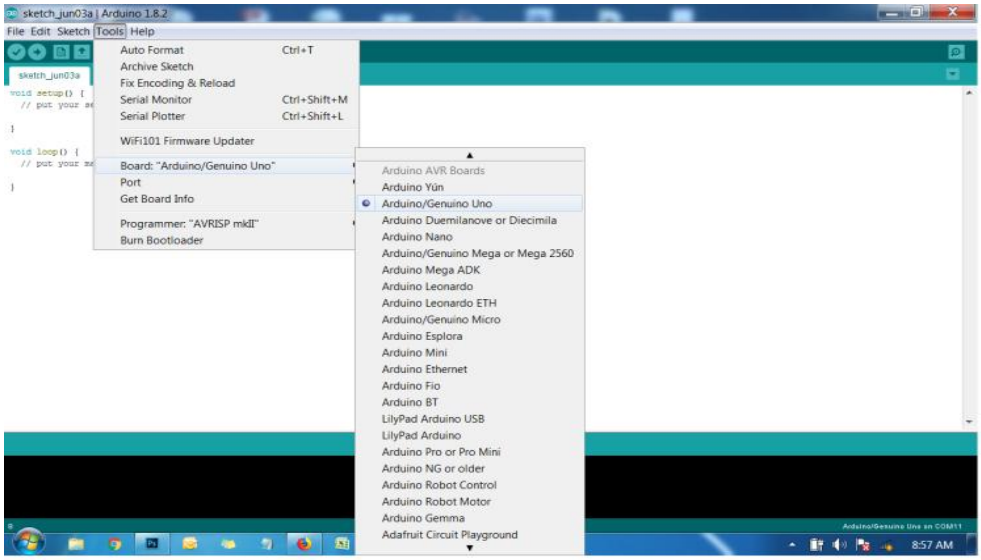
Open Arduino ide software then the following window will open. And the programming structure is explained clearly in software development.



Step 2

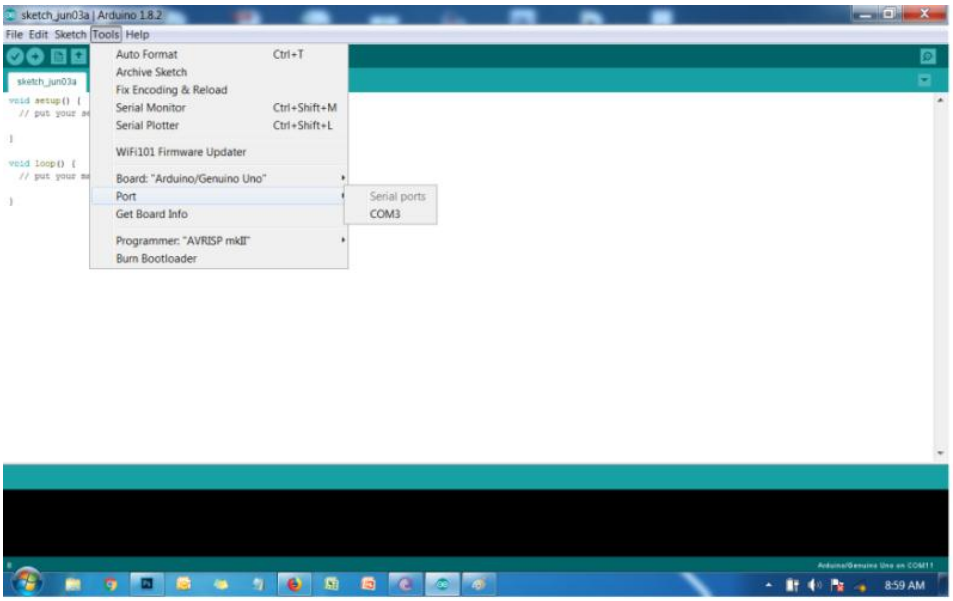
Then go tools and select the Arduino board which we are using in our project. As we are using Arduino Uno select the Arduino/Genuino Uno and start writing the program.





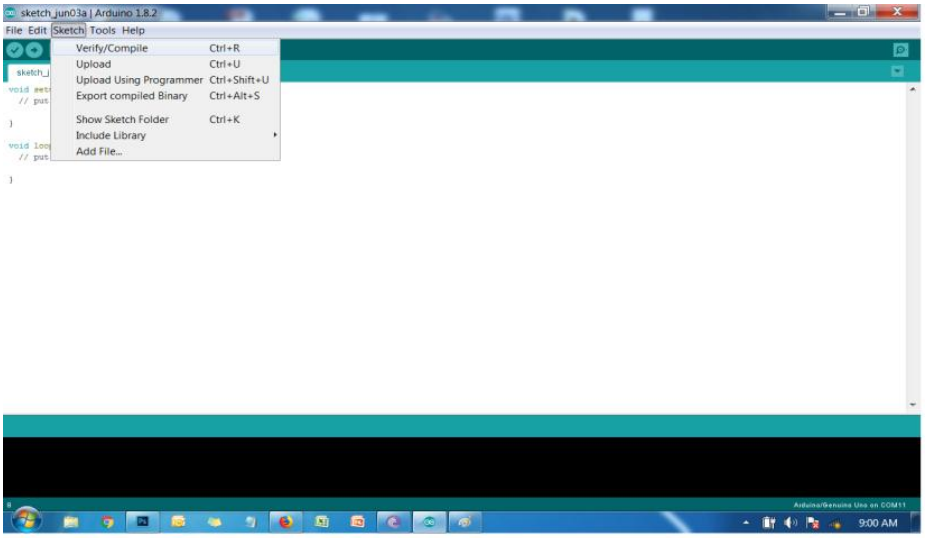
Step 3

Then Select the port to which the Arduino is connected to program the Arduino.



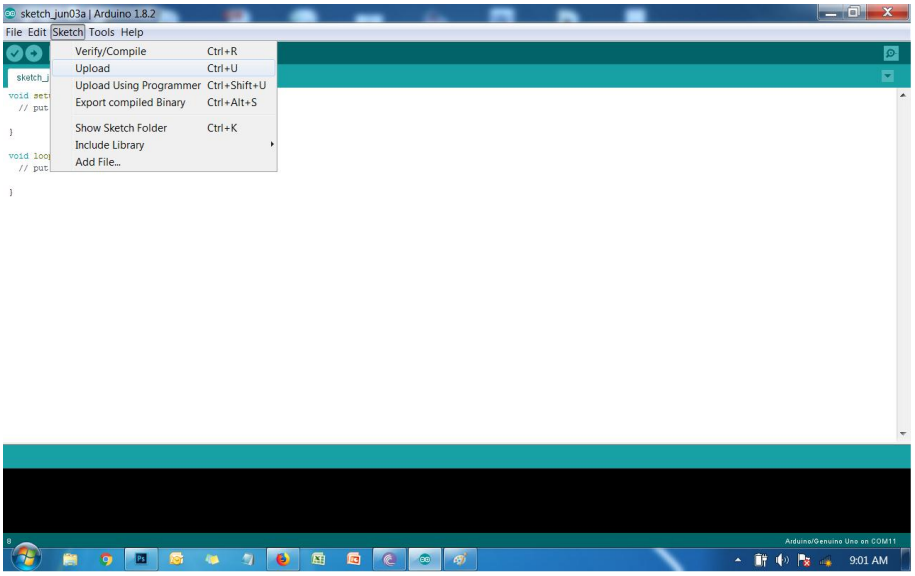
Step 4

After writing the program compile the program for that select the sketch and then click on Verify/Compile or else simply press Crtl+R, so that your program will verify and compile if there are any errors the errors will displayed. Correct those errors and compile once again.



Step 5

The final step is to upload the program to the Arduino Uno board so for that select the sketch and click on Upload or else simply press Ctrl+U, then your program will be uploaded.



VII. RESULT

The final result of this project is that the video has been successfully transmitted with an encrypted key. In this we are using lower band width.

VIII. ADVANTAGES AND DISADVANTAGES

- Off loads the network, when multimedia files are to be transferred by selecting alternate channel avoiding the network congestion.
- Delay less multimedia file transfers are achieved at lower bandwidth. And Cost effective

IX. CONCLUSION

Transmitting video over WSNs is a challenging problem due to limited capabilities of sensor nodes in terms of energy, communication, memory and processing. In this work a new scheme is introduced which is built up on a promising design approach, where cross-layer communication between Application, Network and Physical layers allowed an adaptive and efficient video transmission over WSNs.

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